The Design and Development of the Learning Progression Frameworks for Reading, Writing, and Mathematics

Contents

Introduction

This paper describes the design and development of the reading, writing, and mathematics Learning Progression Frameworks (LPFs). The first section describes the purpose of the frameworks and their underlying rationale, while the second section provides an account of the development process.

Purpose and rationale

Purpose of the frameworks

The LPFs provide a high-level or big-picture view of the typical pathways students take as they make progress in reading, writing, and mathematics from school entry to the end of year 10. There are three frameworks: reading, writing, and mathematics. Each framework comprises seven or eight progressions which describe the different aspects of reading, writing, and mathematics that should be considered to get a comprehensive view of students' progress. Each progression includes the significant signposts that all students are expected to move past as they develop their knowledge and skills and apply them with increasing expertise.

The LPFs are the frameworks used in the Progress and Consistency Tool (PaCT). Teachers locate students on the frameworks as they make judgments in PaCT. The LPFs include psychometrically calibrated measurement scales that are based on teachers' judgments of student achievement rather than direct assessments of the students themselves. The scales have been constructed using the Rasch measurement model.

Constraints

The development teams needed to balance the requirement for enough information about students to ensure dependable judgments against the need for a manageable number of judgments. Given this constraint, it was agreed that it would be appropriate to describe six to eight aspects of student expertise in each of the reading, writing, and mathematics frameworks. It was agreed that, in order to be able to describe students' progression adequately, each framework would include at least 40 signposts.

These constraints provided the framework development team with the initial design parameters.

Design

A number of significant design decisions were made that shaped both the structure and the nature of the frameworks. These are described below.

The frameworks are organised into aspects that focus on particular dimensions of students' achievement in reading, writing, and mathematics.

Each framework in PaCT comprises seven or eight aspects that enable teachers to focus on particular dimensions of student achievement. Together, the aspects cover the breadth of reading, writing, and mathematics described in the New Zealand Curriculum (NZC). Each aspect was developed as a continuum or progression that sets out the significant steps in students' development as they build their expertise in that aspect. In the LPFs, the continuum for each aspect is referred to as a learning progression.

The aspects in the frameworks address the various dimensions of students' performance as they use their reading and writing in curriculum tasks or solve mathematical problems. All three frameworks include a slight overlap between some aspects, because putting a lens on a particular facet of student expertise does not mean that the other aspects are completely out

of view. However, the annotations in the exemplars prompt teachers to focus on the knowledge and skills relevant to the aspect under consideration.

Student expertise is communicated in illustrations.

Illustrations or annotated student work samples are used to communicate expertise. These are clearer than written descriptions, which can be interpreted in a number of different ways. The combination of student work, plus the description included in the annotation, results in illustrations of achievement that carry more meaning than either work samples or descriptions alone.

Sets of illustrations describe the signposts within each learning progression.

Collections or sets of illustrations, referred to as *signposts*, are used to show the significant steps students take as they develop their expertise in each aspect. Each signpost illustrates the breadth of student expertise at that step on the progression. In addition to the illustrations, the development team created a written description of the big ideas that underpin the illustrations at each signpost.

The number of signposts in each aspect was determined by the number of conceptually distinct steps needed to describe the progression in that aspect for students from school entry to the end of year 10. This is in contrast to the NZC, which describes progress using five roughly equivalent levels spanning years 1 to 10. In essence, the development did not set out to describe expertise at each year or curriculum level. Instead, it set out to clearly describe the breadth of developing expertise, and curriculum levels were superimposed on the frameworks once they were complete.

The illustrations are structured to clearly communicate student expertise.

Each illustration includes three key components, and all illustrations follow the same layout. Firstly, an annotation is used to ensure teachers give their attention to the most significant elements of the student work presented in the illustration. Secondly, a description of the learning task is provided. In mathematics illustrations, this is presented as the problem the student is solving; in writing illustrations, this is a task description; and in reading illustrations, both the text the student is working with and the task they are working on are described. The third component is the student response. This includes work samples and/or transcripts of the interaction between the student and the teacher, or the student and their peers. The use of transcripts enables students' thinking to be shown.

The illustrations are focused on students' use of knowledge and skills.

The illustrations focus on the way students use or apply their knowledge and skills in order to meet the literacy demands of curriculum tasks and solve problems in mathematics. Discrete items of knowledge and skill are not explicitly described, but are nonetheless evident in the student responses provided by the illustrations.

In literacy, the focus is on increasingly complex texts and increasingly sophisticated tasks in curriculum areas that are also increasing in difficulty. Although care has been taken to ensure the literacy demand illustrated is in line with the curriculum demand illustrated, the frameworks are intended to describe literacy expertise only, not expertise in the learning areas of the curriculum.

The illustrations are familiar to teachers and straightforward to use.

The reading, writing, and mathematics frameworks are designed to meet common design specifications. This ensures continuity between the three frameworks and makes them easier for teachers to use.

The illustrations are designed to reflect everyday classroom tasks and typical teaching and learning programmes. The upper end of the reading and writing frameworks includes

illustrations that are set in the context of three different learning areas: English, science, and the social sciences. These three areas were selected because together they represent a broad coverage of the curriculum. They also allow secondary teachers to focus on illustrations that are most relevant to their teaching area.

The illustrations are designed to prompt teachers to think, “Can my student do things like this?” It is not intended that teachers replicate the learning tasks described in the illustrations, but rather that they consider students’ performance on learning tasks within their own programme that draw on the same or a similar set of knowledge, skills, and attitudes. This ensures that teachers can use the frameworks within the learning programmes they have developed and with the diversity of students in their class.

The illustrations describe work students can do independently. When teachers are deciding whether the illustrations reflect the expertise of their own students, they need to ask themselves, “Is this the kind of thing my students can do most of the time, by themselves?” To increase clarity, the illustrations include a description of the level of support provided to the student. For example, the reading illustrations specify how many times the student has worked with the text previously.

Each illustration within a set is designed to describe a different element of student expertise, so no parallel problems or tasks are included. This increases manageability for teachers by ensuring that each set includes the minimum number of illustrations needed to describe students’ expertise. It also ensures that a comprehensive view of student expertise is provided. For example, within the mathematics framework, each set of the multiplicative aspect includes multiplication and division problems, in combination with different problem types (result unknown, start unknown, or change unknown).

Formatting elements, such as bullet points and bold text, are used to focus teachers’ attention on parts of the longer annotations in the reading and writing illustrations. This increases clarity for teachers by guiding them to notice specific knowledge and skills.

The frameworks describe student expertise from school entry to beyond the end of level 5 of the NZC.

At every point, the frameworks describe student capability in terms of what students know and can do. A deliberate decision was made to avoid deficit thinking, so even the lowest set in each aspect describes what students can do.

The frameworks have been designed to describe capability from school entry to the end of year 10. They describe the expertise of both the most and least highly-achieving students within this period.

Methodology

This section describes the process used to develop the LPFs. An overview of each phase of the development process is provided.

The LPFs were developed by Education Technology Limited in partnership with the New Zealand Council for Educational Research (NZCER). Education Technology led and coordinated the teams of subject matter experts who designed the frameworks. NZCER was responsible for designing the psychometric research programme that informed the development, trialling the frameworks, and constructing the reporting scales.

While the overall process is described in reasonably linear terms, it was iterative in nature.

Overview

The Ministry of Education initiated the framework development by convening two one-day workshops (April and August 2011). Experts in literacy, mathematics education, and assessment met to outline key design elements. The design of the frameworks originated from these workshops, along with an initial draft of potential aspects for each of the three areas. The composition of the aspects within each of the reading, writing, and mathematics frameworks is described in detail in three information papers[123].

Once the aspects for each framework had been confirmed, the frameworks were developed using six phases, which are described below.

Phase 1: initial development

The initial development phase included:

- mapping the aspect to identify the number and content of the signposts
- drafting illustrations for each signpost
- collecting samples of student work for each illustration
- annotating each illustration
- carrying out an exploratory pilot with a small group of teachers
- style editing all illustrations
- reviewing and carrying out quality assurance of the completed aspect.

The first stage entailed developing big-idea maps for each aspect. These maps specified the number of sets for the aspect, along with ideas for potential illustrations for each set. Initially, the content of the first and last sets was identified to ensure that each aspect spanned the progression from new-entrant learners to those at the end of year 8. Following this, the content of the intervening sets was teased out into significant and discrete steps.

The second stage of the development process involved drafting the required illustrations. This was a collaborative process, with an initial draft generally completed after discussion between members of the development team. Feedback was provided, with consequent revision as required. In practice, the illustrations were drafted alongside the tasks of sourcing work samples and finalising annotations, as some illustrations originated from the aspect map directly, while others had their origins in a particular work sample.

Developers sourced work samples for the illustrations by working with several schools that they had existing relationships with. Copies of students' work were collected with teachers' assistance, and parental/caregiver permission to reuse the samples was obtained. Where necessary, work samples were edited by the developers to ensure they clearly represented the key features required. In each case, care was taken to preserve the sample's authenticity. The annotation of each illustration was carefully edited to ensure it drew teachers' attention to key features of the work sample, while remaining as brief as possible.

An exploratory pilot with a small group of teachers was carried out to investigate whether the illustrations for each aspect were being interpreted as intended, and whether the teachers regarded the learning tasks and student responses as authentic. The pilot was small-scale and reasonably informal. Two developers based themselves at a school for the day, and approximately six teachers were withdrawn from their classes, one at a time, to participate. Illustrations were presented in a random order. Teachers judged the achievement of three students in their class in relation to each illustration, rating the student work presented in the illustration as too sophisticated, about right, or too easy for their student. Teachers also had the option of stating they were unsure. Each teacher then grouped the illustrations into sets of increasing difficulty. One developer led the task and the discussion, while the second used a spreadsheet to collect and analyse the results. Teachers' rationales and any issues raised were collected anecdotally. Following the pilot, developers met to discuss the results and agree on any changes required. These included edits to change the perceived difficulty of the illustrations or to increase the authenticity of the work presented. A small number of illustrations were also deleted at this stage because teachers had misinterpreted them.

Following the exploratory pilot, a style edit was carried out on the illustrations for each aspect. This process was simplified by the use of a development template, but involved an editor reviewing all of the illustrations in each aspect to ensure consistency was maintained. Proof-reading also took place at this stage. The developers reviewed all the changes suggested by the editor to ensure the original intention was maintained.

An independent subject-matter expert reviewed each completed aspect and provided written feedback. Feedback was attended to as required, before the aspect was delivered to NZCER. NZCER then also reviewed each aspect, with consequent minor editing as required.

Phase 2: Aspect refinement

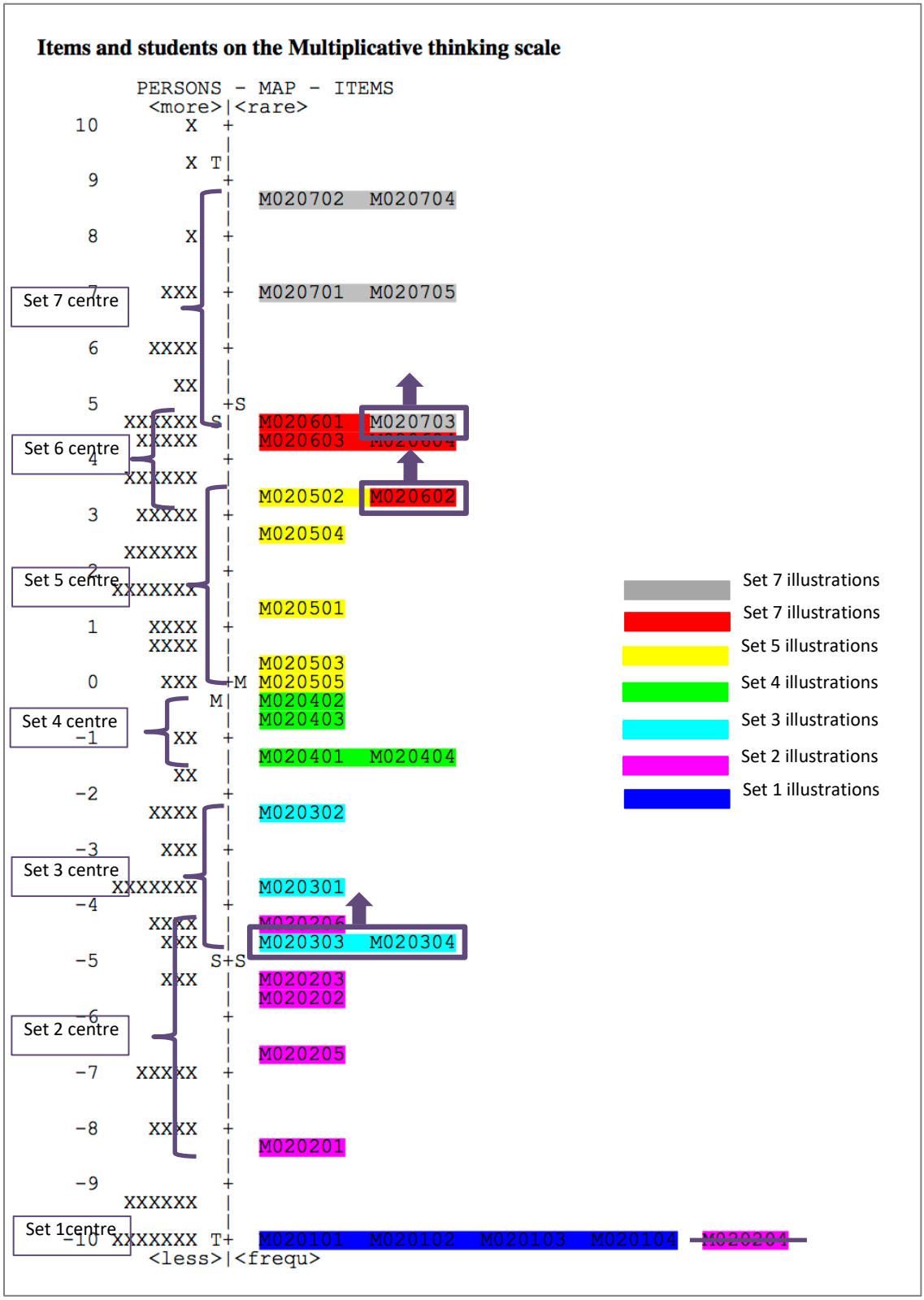
Aspect pilots were carried out by NZCER to provide information about the relative difficulty of all illustrations in each aspect, as perceived by teachers. Approximately 15 teachers participated in each pilot and completed the task independently. Each teacher made judgments in relation to approximately ten students in their class. They were asked to compare the achievement of each student with each illustration in turn. Anecdotal information about teachers' interpretation of the illustrations, along with their opinions, was also collected.

A Rasch analysis was carried out to create a measurement scale for each aspect, and person and item maps were produced. These enabled illustrations to be identified if they did not appear to discriminate between levels of achievement or were judged by teachers to be much harder or much easier than expected. As a result of these pilots, some illustrations were edited to increase or decrease their perceived difficulty, some illustrations were regrouped within sets, and a small number of illustrations were deleted. Once all of the aspects within a framework had undergone an aspect pilot, the sets of illustrations were ready to be used as one unit.

Figure 1 shows the person and item map that was produced from the aspect refinement pilot for one of the mathematics aspects. It shows the relative difficulty of all illustrations in the multiplicative thinking aspect. The illustrations increase in perceived difficulty from the bottom of the image to the top. Figure 1 also indicates the illustrations that were edited as a result of the aspect pilot and the intent of that edit.

To analyse the spread of the sets of illustrations over the scale, the centre of each set of illustrations was identified, and these positions were compared. The brackets at the left of Figure 1 show these positions, indicating that in general the sets of illustrations performed as expected, with each set of illustrations progressively more difficult than the preceding set.

Figure 1: Multiplicative thinking aspect pilot results

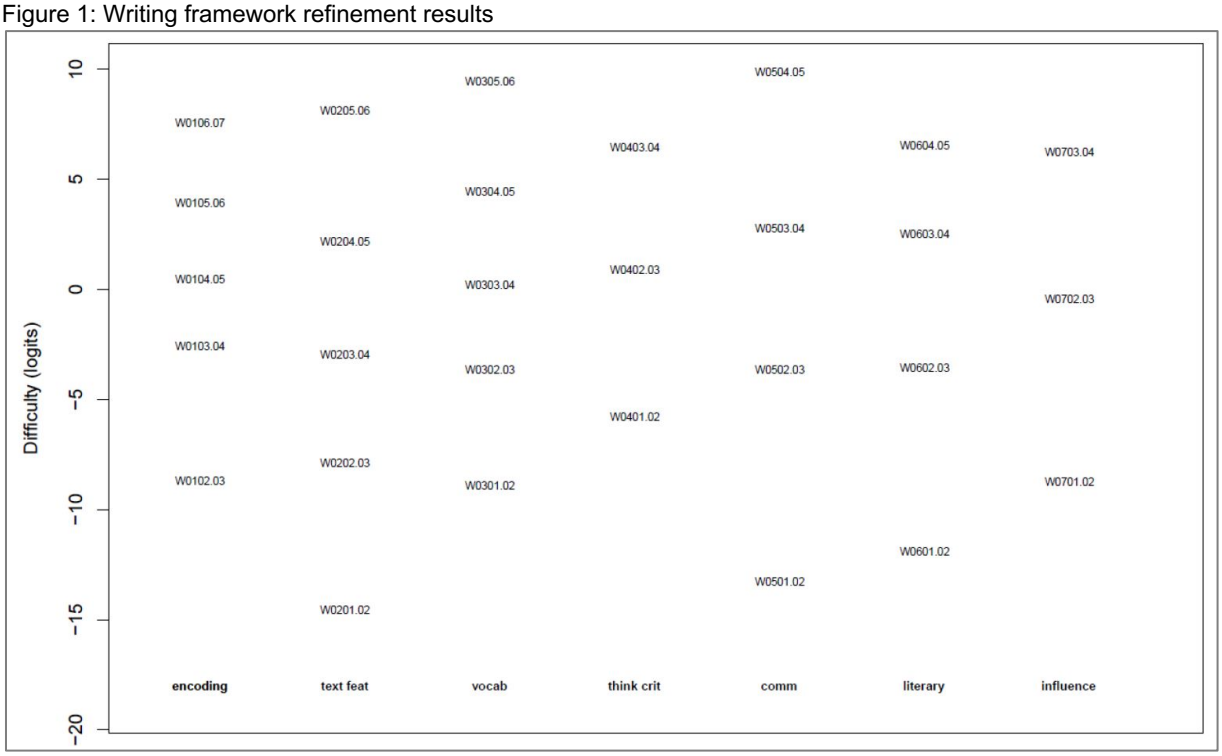


Phase 3: Framework refinement

A series of one-day workshops for teachers took place to trial each of the reading, writing, and mathematics frameworks. At these workshops, a total of approximately 60 teachers used each framework to make judgments for approximately ten students in their class. This required them to select the set of illustrations within each aspect that they judged to be the "best fit" for each student. All participating teachers completed a survey about their experiences of using the framework, and those with students in years 4 to 8 also administered standardised assessment tests at this time.

A Rasch analysis was carried out to construct an underlying measurement scale for each of the three frameworks. This located all the sets for all of the aspects on a single measurement scale. In turn, this provided the relative levels of sophistication of signposts within and between aspects, and indicated whether consecutive signposts within an aspect increased in perceived difficulty as expected. The boundaries between each signpost were also identified. Figure 2 shows the underlying measurement scale for the writing framework and the boundaries between each signpost. The measurement scale runs vertically up the figure, and the boundaries between the sets are indicated by codes. For example, W0201.02 is positioned at the boundary between sets one and two on the using knowledge of text structure and features aspect. The names of the aspects are given in abbreviated form at the bottom of the figure.

Figure 1: Writing framework refinement results



All of the boundaries between the sets appeared in their intended orders and were well spread over the range of possible difficulties. This indicated that the framework was sound, and no more changes were made.

Phase 4: Construction of a reporting scale

NZCER conducted a national trial of each framework in order to calibrate the values at which the signposts would be located on the reading, writing, and mathematics scales. Each trial involved approximately 200 teachers from a nationally representative sample of approximately 100 schools. Participating teachers were asked to make judgments on at least ten students selected at random from their class. They selected the set of illustrations within each aspect that was the "best fit" for each student's achievement. The participating teachers completed a survey about their experiences of using PaCT, and those with students in years 4 to 8 also administered standardised assessment tests around this time.

A Rasch analysis was carried out to construct the measurement scales for the LPFs.

Phase 5: Alignment to National Standards and the New Zealand Curriculum

Alignment workshops were conducted by NZCER, with support from the lead developers, to establish the relationship between the measurement scales, the National Standards in reading, writing, and mathematics, and the levels of the NZC.

Generally, each of the alignment workshops took two days and involved eight judges, working in pairs. Judges were recruited on the basis of their knowledge and understanding of teaching and learning in the area (reading, writing, or mathematics).

An extended Anghoff approach was used, which involved participants making judgments and discussing results in detail. Cut points, which indicated the minimum scale score associated with each National Standard and level of the curriculum, were determined and located on the measurement scale.

Phase 6: Extending the frameworks to include years 9 and 10.

In 2013-14 the reading, writing, and mathematics frameworks were extended to include students to the end of year 10. Students in years 9 and 10 need to develop the literacy-related knowledge, skills, and attitudes that are specific to subject areas. This knowledge and these skills are shaped by the kinds of texts and tasks that the curriculum requires them to engage with in order to think about and communicate in ways that are appropriate to a particular subject. The implications for teaching are significant: the literacy expertise that students need to develop in order to meet, for example, objectives at level 5 in the science curriculum is best taught within the science programme, rather than relying on students being able to apply generalisable skills they've learned in English.

Accordingly, the reading and writing frameworks were extended to include illustrations that are set in the context of three different learning areas: English, science, and the social sciences. These three areas were selected because together they represent a broad coverage of the curriculum, so most teachers will be able to find areas that are relevant to their work.

However, unlike the reading and writing frameworks, the illustrations in the mathematics framework focus on the mathematics and statistics learning area as it was expected that the exemplars would be accessed and used primarily by mathematics teachers.

The development process for extending the frameworks was similar to the process outlined in phases 1 to 5 above. Developers first identified appropriate reading and writing tasks and texts, and mathematics problems for the illustrations, then sourced student work samples and annotated these to clarify the key features of the work. Three exploratory pilots (reading, writing, and mathematics) were held to investigate the relative difficulties of the new illustrations and their alignment to the existing signposts. Alignment workshops were then held to establish the relationship between the new signposts and the levels of the NZC.

[1] *A rationale for the seven aspects in the reading framework*. Located in the resources column at https://curriculumprogresstools.education.govt.nz/lpfs/understanding-the-reading-framework/

[2] *A rationale for the seven aspects in the writing framework*. Located in the resources column at https://curriculumprogresstools.education.govt.nz/lpfs/understanding-the-writing-framework/

[3] *A rationale for the eight aspects in the mathematics framework.* Located in the resources column at https://curriculumprogresstools.education.govt.nz/lpfs/understanding-the-mathematics-framework/