Curriculum integration:

What is happening in New Zealand schools?

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Executive summary

This report presents the findings from a research project on curriculum integration in New Zealand schools, carried out by NZCER in 2018–19. The purpose of the research was to explore teachers' rationales for curriculum integration; the approaches and practices used to integrate curriculum; and the learning opportunities such approaches provide for students.

What did we want to find out?

Our research questions were:

- What sorts of outcomes do teachers envisage when they integrate subjects (i.e., what are their purposes for doing so)?
- What sorts of topics are used to integrate learning across learning areas?
- How is integration achieved in practice? (For example, how are different learning areas differentiated and/or juxtaposed?)
- What is taught about the knowledge-building (epistemic) processes of each discipline?
- What learning opportunities does curriculum integration afford students, and do the opportunities differ for different groups of students, including those traditionally underserved by the education system?

How did we collect our data?

We included a small number of questions in the NZCER 2018 National Survey of Secondary School Principals and Teachers (Bonne & MacDonald, 2019). Our aim was to gain a broad understanding of school and teacher engagement in curriculum integration at the secondary school level.

We carried out three one-day workshops using mediated conversations (Cowie & Hipkins, 2014) for 23 primary and secondary school teachers who had experience planning and teaching units of work that integrated two or more learning areas. These workshops were held in Auckland, Wellington, and Christchurch. Eight of the teachers were from primary schools, 13 were from secondary schools, and two worked at Years 7–10 in junior high school programmes. There was a mix of primary and secondary school teachers at each workshop.

What did we learn from the national survey?

Over half of secondary schools integrate curriculum at some levels

Over half of the principals who responded to the survey indicated that within the last 3 years their school had trialled integrating at least two learning areas at one or more levels of the school. Just under one-third (30%) of the responding teachers said they had been involved in curriculum integration in the past 3 years. Responses from principals and teachers indicate that students' opportunities to experience curriculum integration decrease with year level. Curriculum integration is more likely to be happening at Year 9 or, to a lesser extent, at Year 10.

What did we learn from those who had tried integration?

Principals and teachers saw curriculum integration experiences as successful

Over two-thirds of principals (76%) and teachers (68%) rated their experiences with integration as successful or very successful. The majority of teachers who had trialled curriculum integration agreed or strongly agreed that the integration of learning areas (as compared with teaching the same learning areas separately) provides students with opportunities to build meaningful relationships between learning areas (77%), is more engaging for students (65%), and that students learn more about the nature of the different subjects involved (59%). Just under half of teachers agreed or strongly agreed that student learning outcomes are better.

Teachers identified positive and negative impacts on their work

In response to eight Likert-scaled items describing potential positive and negative impacts on their work, just under three-quarters of the teachers indicated that when teaching using an integrated approach they found it: easier to explore authentic issues and contexts (74%); more stimulating to work with another teacher (72%); or more engaging for them as a teacher (68%).

A sizeable minority agreed or strongly agreed that: an integrated course is more work to teach (43%); it is more difficult to cover each subject in depth (42%); integration caused timetabling difficulties in their school (38%); it is more difficult to align an integrated course with the National Certificates of Educational Achievement (NCEA) (38%); and that such courses are more work to assess (36%).

Science and mathematics teachers were more likely to agree or strongly agree that integration made it more difficult to cover subjects in depth. This is consistent with feedback from the workshops.

What did we learn from schools that had *not* tried integration?

Thirty-nine percent of principals and 70% of teachers said they had not experienced curriculum integration in the past 3 years. The two reasons most frequently identified by principals were that it is too hard to timetable, and that subject coverage would be too superficial. The two reasons

most frequently identified by *teachers* for not integrating were concern about depth of subject coverage, and the perception that school leaders would not support integration.

What did we learn from the workshops?

The workshops enabled us to explore findings from the national survey of secondary school teachers in more depth. We included primary school teachers in the workshops so that we could benefit from experiences of teachers working at different levels, and within different contexts.

Why do teachers integrate curriculum?

The main reasons the workshop teachers gave for integrating curriculum were to:

- provide students with opportunities to explore relevant and authentic issues
- enhance opportunities for *all* students to achieve
- provide opportunities for students to develop capabilities for 21st century learning
- provide opportunities for students to "see connections" and "go deeper"
- enable more efficient curriculum delivery and use of time.

How do schools organise for curriculum integration?

The teachers who attended the workshops described a variety of ways in which their schools had developed structural arrangements for curriculum integration and explained how these structures were continuing to evolve. These included:

- integration that does not impact timetabling
- small-scale experimentation involving pairs of teachers
- creating an integration strand within the larger timetable
- integrating learning for whole cohorts
- structuring for comprehensive whole-school integration.

A common theme in each workshop was that it is not easy to design an integrated curriculum that works as intended right from the outset. Many secondary participants described rolling adjustments to the structural changes their schools had been making as they learnt more about what worked and what did not.

How do teachers work together?

The extent to which teachers worked together varied. In some cases, collaboration was restricted to the planning stage: teachers kept in touch with each other's work in the classroom, but it was essentially up to them as individuals to create the sense of coherence between the different learning experiences once these had been decided upon. In other cases, the teachers continued to work together as a team during the learning, often in larger learning spaces.

The number of teachers working together also varied, ranging from pairs of teachers, larger teams (such as those working within an "integration stream" of a bigger timetable structure), and in a few cases, the whole staff of the school working together to design an integrated programme that worked across every level of the school.

Curriculum integration in practice: Approaches to planning and teaching

Curriculum integration was usually part of a wider suite of pedagogical approaches such as: student-led inquiry; personalised learning; play-based learning; team teaching; flexible use of time and space; and multilevel/age classes or groups. Students had some choice about their topics of inquiry within the integrated unit of work or strand. The degree of student choice ranged from almost total free choice through to a narrow range of choice within teacher predetermined topics and with criteria that needed to be met to ensure coverage.

The most frequently integrated learning areas were English, the arts, and the social sciences. The least frequently integrated was maths, followed by science. Reasons for not integrating maths and science usually related to the hierarchical nature of the knowledge development in these areas and the need to teach concepts in a certain order.

The role played by each of the learning areas being integrated ranged within and between schools. At many schools, the "content" focus for learning was situated in one learning area. We often heard about science, with English or the arts providing the means for *disseminating* the learning, for example, in "celebrations of learning". There was variation in the extent to which aspects of these "dissemination" subjects were explicitly taught.

What about disciplinary knowledge?

Many teachers saw the main challenge of curriculum integration as "finding the balance between student agency and knowledge". Teachers who were grappling with the balance between knowledge and agency often responded to this challenge by "pre-loading knowledge" using more traditional explicit instruction approaches before allowing students to pursue inquiries that involved more than one learning area. Others took more of a "just-in-time" approach, taking mini lessons (again, using more traditional explicit instructional approaches) as and when they were needed for groups or individual students.

Teachers were on a continuum in their views about the importance of disciplinary knowledge in the curriculum. All teachers considered knowledge to be important in curriculum integration— albeit to varying degrees. For some, opportunities to develop cross-disciplinary capabilities, competencies, or dispositions were as, if not more, important than opportunities to build knowledge. Fewer teachers commented on the need to focus on discipline-specific capabilities, competencies, or dispositions (i.e., disciplinary discourses and practices).

At some schools, teachers described using "experts" to carry out this discipline-specific explicit instruction. These experts could be other teachers, parents, or members of the wider community with the appropriate expertise. At some schools, teachers used a Mantle of the Expert (Heathcote & Bolton, 1994) approach, to switch roles from "classroom teacher" to, for example,

"palaeontologist" to engage in discipline-specific conversations about knowledge. Still others co-opted parents to take on such roles. The advantage of such approaches is the opportunity for the expert to not just address the discipline-specific knowledge needs of the students, but also to model discipline-specific discourses and practices.

How did teachers approach assessment?

All the workshop teachers had grappled with how to assess in the context of open-ended, student-led inquiries spanning more than one learning area. There was a range of approaches to assessment including:

- choosing not to assess some aspects of student learning
- using traditional subject-specific assessments alongside new integrated approaches to teaching and learning
- creating rubrics or progressions for assessing competencies, capabilities, or values (often viewed as generic across learning areas)
- creating rich assessment tasks to provide evidence of students' knowledge and/or capabilities in the separate learning areas being integrated
- creating rich assessment tasks to provide evidence of students' integration and application of the knowledge and capabilities of several learning areas.

What did teachers notice in terms of student engagement and learning?

Many teachers considered that most (but not all) of the students they taught were more engaged in the approaches they were trialling than previous approaches. This was particularly so for students who had traditionally struggled to engage in learning.

Many teachers found that students took their thinking to a "deeper" level during the approaches to learning being trialled. Teachers attributed this deeper level of thinking to:

- increased student motivation for topics they had chosen themselves or saw as important
- more complex topics that *invited* a deeper level of thinking, or
- the perception that there was "more time" to explore their topics of inquiry (often due to the "bundling" of ideas across learning areas).

Teachers also found that the approaches they were trialling provided opportunities for students to develop and demonstrate a wider *range* of capabilities than provided by previous approaches.

What is difficult to ascertain is the extent to which the increased engagement and achievement teachers perceived might be attributed to the other new pedagogies being trialled versus the extent to which it might be attributed to the actual integration of the learning areas.

Most teachers' perceptions were that student outcomes were as good, if not better than, they would have been if the subjects had been taught separately. However, not surprisingly, few teachers had achievement data to make it possible to make this comparison in a standardised way.

1.   Introduction and overview

This report presents the findings from a research project on curriculum integration in primary and secondary schools, carried out by NZER in 2018–19. Curriculum integration is supported by *The New Zealand Curriculum* (Ministry of Education, 2007), which states that:

> The curriculum offers all students a broad education that makes links within and across learning areas. (p. 9)

and that:

> While the learning areas are presented as distinct, this should not limit the ways in which schools structure the learning experiences offered to students. All learning should make use of the natural connections that exist between learning areas and that link learning areas to the values and key competencies. (p. 16)

Curriculum integration is widely adopted in primary schools, and it is becoming increasingly common in secondary schools.

Our research purpose and design

The purpose of this research was, in the first instance, to gain some understanding about what is happening now in the curriculum integration space in New Zealand primary and secondary schools. We wanted to explore teachers' rationale for curriculum integration; the approaches and practices used to integrate curriculum; and the learning opportunities such approaches provide for students.

What were our questions?

Our research questions were:

- What sorts of outcomes do teachers envisage when they integrate learning areas (i.e., what are their purposes for doing so)?
- What sorts of topics are used to integrate learning across learning areas?
- How is integration achieved in practice? (For example, how are different learning areas differentiated and/or juxtaposed?)
- What is taught about the knowledge-building (epistemic) processes of each discipline?
- What learning opportunities does curriculum integration afford students and do the opportunities differ for different groups of students, including those traditionally underserved by the education system?

How did we collect and analyse our data?

We collected our data through survey questions and through mediated conversation workshops (Cowie & Hipkins, 2014).

Survey questions

We included a small number of questions in the NZCER 2018 National Survey of Secondary School Principals and Teachers (Bonne & MacDonald, 2019). Our aim was to gain a broad understanding of school and teacher engagement in curriculum integration at the secondary school level. We wanted to find out how many schools and teachers had engaged in some form of curriculum integration in the last 3 years; their reasons for doing so (or not); the year levels involved; and perceptions of the experience.

Teacher workshops

We carried out three one-day workshops for primary and secondary school teachers with experience of planning and teaching units of work that integrated two or more learning areas. These workshops were held in Auckland, Wellington, and Christchurch.

We used our connections to identify primary and secondary school teachers involved in curriculum integration. They came from schools representing a range of deciles. Twenty-three teachers participated in these workshops—eight in each of Wellington and Auckland, and seven in Christchurch. Eight of the teachers were from primary schools and 15 were from secondary schools. There was a mix of primary and secondary school teachers at each workshop.

We used a mediated conversation methodology (Cowie & Hipkins, 2014) at the workshops. Mediated conversations are a method for generating rich qualitative data on complex issues such as those found in fields like education. The method is sociocultural in that it highlights the role of artefacts and audiences in mediating participants' actions and thoughts. The method is participatory, with benefits for both researchers and participants.

We asked each of the participating teachers to prepare a story to share with other teachers. This story was to focus on their experiences of curriculum integration at their school. We gave teachers some guidance about how to shape this story by providing them with some suggestions about relevant content. These included:

- why they chose their story
- what the learning was about
- what learning areas were integrated
- what they hoped the students would gain and why they thought that was important
- how they planned for the teaching and learning
- how they organised across the learning areas
- how they managed the different areas of knowledge being integrated
- what they did and what was involved
- what they assessed, and why
- how the teachers worked together

- any impact they observed on the engagement and learning of the different students involved.

The mediated conversations occurred initially in small groups, consisting of two to four teachers and one researcher. Each teacher presented a story that recounted their curriculum integration experiences. The groups then responded to these stories—discussing similarities and differences in experiences, which led to further story telling. Each group then shared the themes of these conversations with the wider group. This also led to further conversations and theory building.

How is our report structured?

At the beginning of the project we searched for and read recent classroom-based studies of curriculum integration in New Zealand. Section 2 discusses insights from this literature. Section 3 then presents the findings from questions on curriculum integration we included in the 2018 National Survey of Secondary School Principals and Teachers. In Section 4 we focus on teachers' purposes for engaging in curriculum integration; in Section 5, on school-level organisation for curriculum integration; in Section 6, on thinking about subjects and knowledge; in Section 7, on the dynamics of teacher knowledge growth; in Section 8, on approaches to assessment; in Section 9, on students' learning and engagement; and in Section 10 the support teachers engaging in curriculum integration need. We conclude with a discussion of our findings and their implications.

2. Insights from the research literature

This section discusses what we found when we reviewed recent classroom-based studies of curriculum integration in New Zealand. Despite the literature being rather sparse, we found some interesting patterns, particularly in thinking about the "why" of integration, but also about the sort of curriculum content that lends itself to being integrated.

Foregrounding student agency and relevance

It was common for classroom-based research to make a binary distinction between "thematic" and "democratic" integration models, where the democratic model is seen as preferable.

Thematic models are essentially a type of *contextual* integration which is pre-planned by a team of teachers and is topic- or theme-centred. A broad topic is chosen and subsequently used as a contextual setting for subject-based learning, designed as the teachers see fit. Two main criticisms are made when contrasting a thematic model with a democratic model:

- Students do not have ownership of the topic or context. In this respect, the curriculum is not seen as being any more democratic than a traditionally prescribed curriculum. Consequently, students may not perceive any more relevance or interest than they would in traditional lessons.
- It may be left to students to draw the connections between different learning experiences within the overarching topic, and hence their learning might not be any deeper, or more transferable, than traditional discrete learning experiences.

The origins of the democratic model are attributed to John Dewey (1916) and, more recently, James Beane (1997, 2005). Integration is achieved when students pursue an inquiry that brings different subjects together. Ideally, this inquiry begins with students' own questions and interests—hence the democratic label—and is student-centred.

Within so-called democratic models, different means are used to stimulate curiosity and questioning. At one end of the continuum, integration springs from "teachable moments" that arise spontaneously. The teacher responds to students' questions or concerns by supporting them to learn more and, if relevant, take action (Brough, 2012). At the other end, teachers decide on the theme or overarching question, but contrive to personalise this so that students can bring their own lived experiences to bear. When James Beane is cited, big questions such as "Who am I?" are likely to be used for this purpose.

There are several recent New Zealand classroom-based studies on democratic models of curriculum integration (Brough, 2012; Dowden & Fogarty-Perry, 2017; Fraser, Aitken, Price, & Whyte, 2012; Fraser, Aitken, & Whyte, 2013). The findings of these studies suggest that student-led, democratic approaches to curriculum integration can provide relevant, engaging, and

equitable learning environments, can enhance the value and impact of students' learning, and can empower students to make a difference in their communities by addressing issues related to diversity, inclusion, and social justice. For example, a major Teaching and Learning Research Initiative (TLRI) study explored integration of arts disciplines with other learning areas (Fraser et al., 2012). The study raised questions about what the arts contribute to integration, and what it means to be an educated, ethical person. The researchers noted that positioning children as competent and capable by using drama pedagogies such as Mantle of the Expert (Fraser et al., 2012) fosters their ownership of their learning and influences the nature of their interactions with adults and peers.

Foregrounding knowledge, discourses, and practices

A focus on disciplinary knowledge

One of our interests in this research is the opportunities that integrated learning experiences provide for students to develop disciplinary knowledge. Several of the studies that investigated such opportunities found that a focus on knowledge was often overlooked by teachers in planning, teaching, and especially assessment (Arrowsmith & Wood, 2015; Dowden, 2014; McPhail, 2018; Morey, 2008; Taylor, Urry, & Burgess, 2012; Wood & Sheehan, 2012).

For example, Wood and Sheehan (2012) analysed the stories of four secondary schools profiled on the New Zealand curriculum online site for their early adoption of *The New Zealand Curriculum* (Ministry of Education, 2007). They highlight the risk that teaching about the disciplinary knowledge underpinning the integrated subjects will be less visible and less explicit. They say this lack of visibility will exacerbate existing inequities in opportunities to learn. They contrast achievement patterns more generally between schools that retain a focus on disciplinary knowledge and those that do not; and between students who already have access to disciplinary knowledge and those who do not.

These studies suggest that planning, teaching, and assessment for the development of learning area knowledge through an integrated curriculum is challenging, even for experienced teachers (Arrowsmith & Wood, 2015; Dowden, 2014; McPhail, 20018 Morey, 2008). Some studies found that one learning area could come to dominate others the in planning, teaching, and/or assessment of integrated units of work or that one subject could be seen as being "in the service" of others (Arrowsmith & Wood, 2015; McPhail, 20018.

Some of the studies found that some combinations of subjects work better than others (McPhail, 2018; Morey, 2008). For example, in a postgraduate research project, Morey (2008) reported that mathematics was especially difficult to integrate—especially with the social sciences. He attributes this challenge to the different orientations mathematics teachers have toward curriculum and assessment, their different perceptions of student motivation, and their different ways of collaborating with colleagues.

A focus on disciplinary discourses and practices

Disciplines have distinctive ways of using language—Moje (2008) uses the term "discourses"—and practices, as well as different forms of knowledge (Gee, 2008; Moje, 2008; Shanahan & Shanahan, 2008; Street, 1984; Wyatt-Smith, Cumming, Ryan, & Doig, 1999). We found few New Zealand classroom-based studies that considered students' opportunities to develop, draw on, or combine the discourses and practices of different disciplines through an integrated unit of work. There was a tendency to interpret discourses and practices in generic rather than discipline-specific terms, a finding consistent with Wood and Sheehan (2012).

Interestingly, two recent studies that did take such a focus came from the early childhood education (ECE) sector. Clarkin-Phillips, Carr, and Paki (2012) and Carr et al. (2014) explored opportunities for children to learn the discourses and practices associated with museums and galleries, as part of a project on teaching and learning at a kindergarten—Tai Tamariki—situated in the Museum of New Zealand Te Papa Tongarewa. The kindergarten teachers in Clarkin-Phillips et al. (2012) and Carr et al. (2014) provided children with opportunities to visit, talk about, and use the gallery spaces in Te Papa, to engage with a range of people who worked there, and to create a gallery space in their kindergarten in which they used the literacies of curators, artists, and docents as they created their own exhibits and exhibitions.

Clarkin-Phillips et al. (2012) found that the specialised language associated with museums and galleries had "become part of the vocabulary" of children at their kindergarten (p. 8). And Carr et al. (2014) found that children began acting as guides, exhibitors, and gallery designers, showing an appreciation of exhibits, following and reminding visiting families of museum protocols, and offering visitors explanations of exhibits and demonstrations of art and craft processes.

A recently completed TLRI research project in the school sector led by Sasha Matthewman (2017) also focused directly on opportunities for Year 9 students at two secondary schools to develop the discourses and practices of different learning areas though a project on ecological sustainability. This involved integrating Education for Sustainability with English, social studies, and art. The teachers planned for and provided students with opportunities to draw on and in some cases combine the knowledges, discourses, and practices of the different learning areas to create artefacts and social/political/environmental commentary on topics of local and wider community importance. There was evidence of positive shifts in students' understanding and use of the discourses and practices associated with the learning areas in question, and in their sense of identities.

3. A national snapshot

The 2018 national survey of secondary schools, *Secondary Schools in 2018: Findings from the NZCER National Survey* (Bonne & MacDonald, 2019), provided an opportunity to gather a national snapshot of the extent to which curriculum integration is happening in New Zealand secondary schools. A nationally representative sample of principals (*n* = 167) and teachers (*n* = 705) responded to this survey, which covered a wide range of current issues.

Sixty-one percent of the responding principals said they had integrated some learning areas in the past 3 years. This sub-group was then asked about the numbers of learning areas involved and the curriculum levels at which the integration had occurred. Table 1 summarises responses. Notice that integration of learning areas tends to decrease with year level. Integrating three or more learning areas is more likely to be happening at Year 9 or, to a lesser extent, at Year 10.

Table 1 **Number of learning areas integrated by year level, reported by principals (n = 101)**

Year level	Number of learning areas integrated				
	2 %	3 %	4 %	5+ %	No response %
Year 9	29	24	11	13	24
Year 10	26	13	10	9	43
Year 11	26	7	1	3	63
Year 12	23	5	2	2	68
Year 13	21	2	2	2	73

Seventy-six percent of the principals who reported integration also said the school's experience was successful or very successful, while 8% said it was not very successful, and 1% said it was not at all successful. For 12% of these principals, it was too soon to tell.

This snapshot suggests that some degree of integration is being implemented in at least half of New Zealand's secondary schools, mostly successfully according to the school leaders.

Teachers' experiences of integration

Thirty percent of the responding teachers (n = 211) said they had been involved in curriculum integration in the past 3 years. This sub-group was then asked about the numbers of learning areas involved and the curriculum levels at which the integration had occurred. Table 2 summarises responses. The overall pattern is like that shown by the principals' responses: integration tends to decrease with year level and integrating three or more learning areas is more likely to be happening at Year 9 or, to a lesser extent, at Year 10.

Table 2 **Number of learning areas integrated by year level, reported by teachers (n = 211)**

Year level	Number of learning areas integrated				
	2	3	4	5+	No response %
Year 9	28	13	7	6	46
Year 10	28	9	2	6	56
Year 11	21	6	2	1	69
Year 12	19	4	2	2	74
Year 13	14	5	1	2	78

Just over two-thirds of the teachers (68%) who reported experience with integration also said it was successful or very successful, 15% said the integration had not been very successful, and 2% said it was not successful at all. Ten percent thought it was too soon to tell.

Perceived benefits of integration

We asked the sub-group of teachers who had experienced curriculum integration how they thought student learning had been impacted. Figure 1 shows their responses to four Likert-scaled statements that described potential positive impacts. Just over three-quarters (77%) thought that integrating learning areas had provided students with opportunities to build meaningful relationships between those learning areas, and two-thirds (65%) thought integrated learning was more engaging for students. Fewer agreed—and more expressed uncertainty—about whether learning outcomes were better, or whether students had learnt more about the nature of the subjects being integrated.

Figure 1 **Effects on students of integrating learning areas, compared with teaching a single subject, reported by teachers (n = 211)**
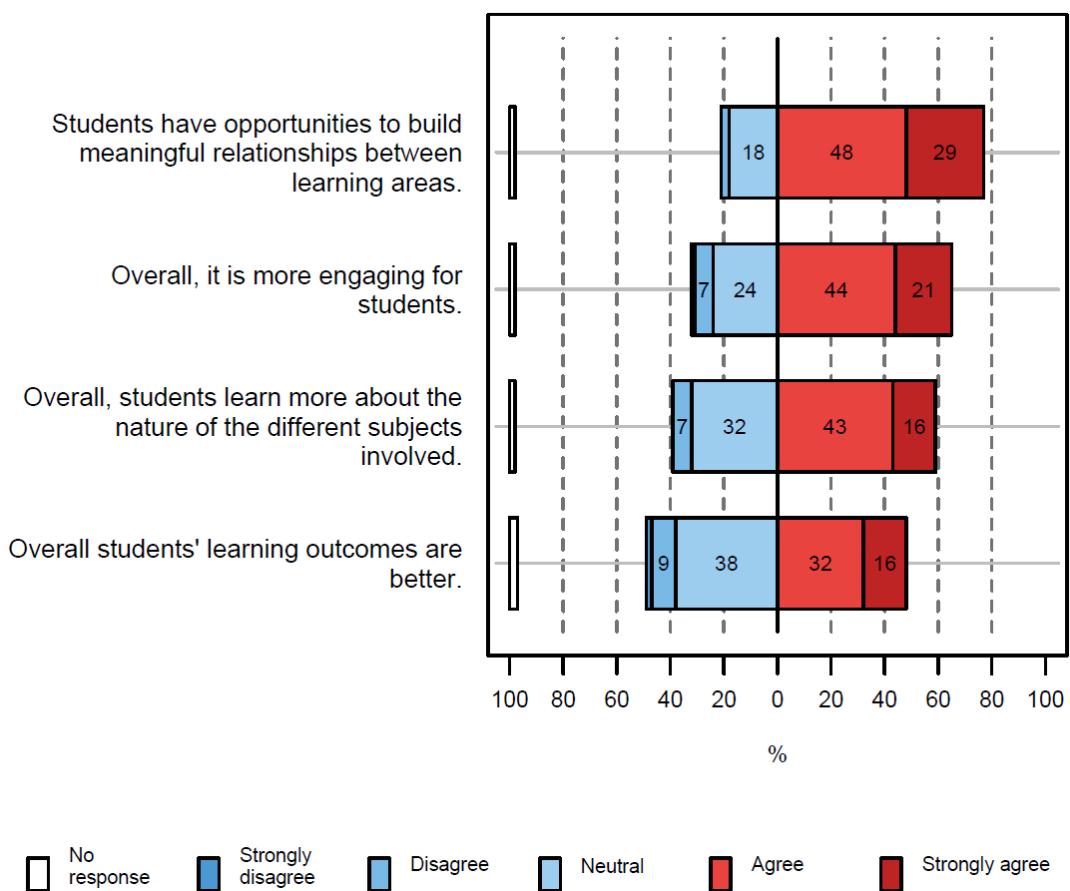
Did the teachers themselves benefit from the integration experience? The same sub-group responded to eight Likert-scaled items: some indicated potential positive impacts, and some indicated potential negative impacts on them and their work. The responses are shown in Figure 2. Just under three-quarters said it was: easier to explore authentic issues and contexts (74%); more stimulating to work with another teacher (72%); or more engaging for them as a teacher (68%).

Views about potential negative impacts were more split. A sizeable minority agreed or strongly agreed that: an integrated course is more work to teach (48%); it is more difficult to cover each subject in depth (42%); integration caused timetabling difficulties in their school (38%); it is more difficult to align an integrated course with NCEA (38%); or that such courses are more work to assess (36%).

Figure 2 **Effects on teachers of integrating learning areas, compared with teaching a single subject (n = 211)**
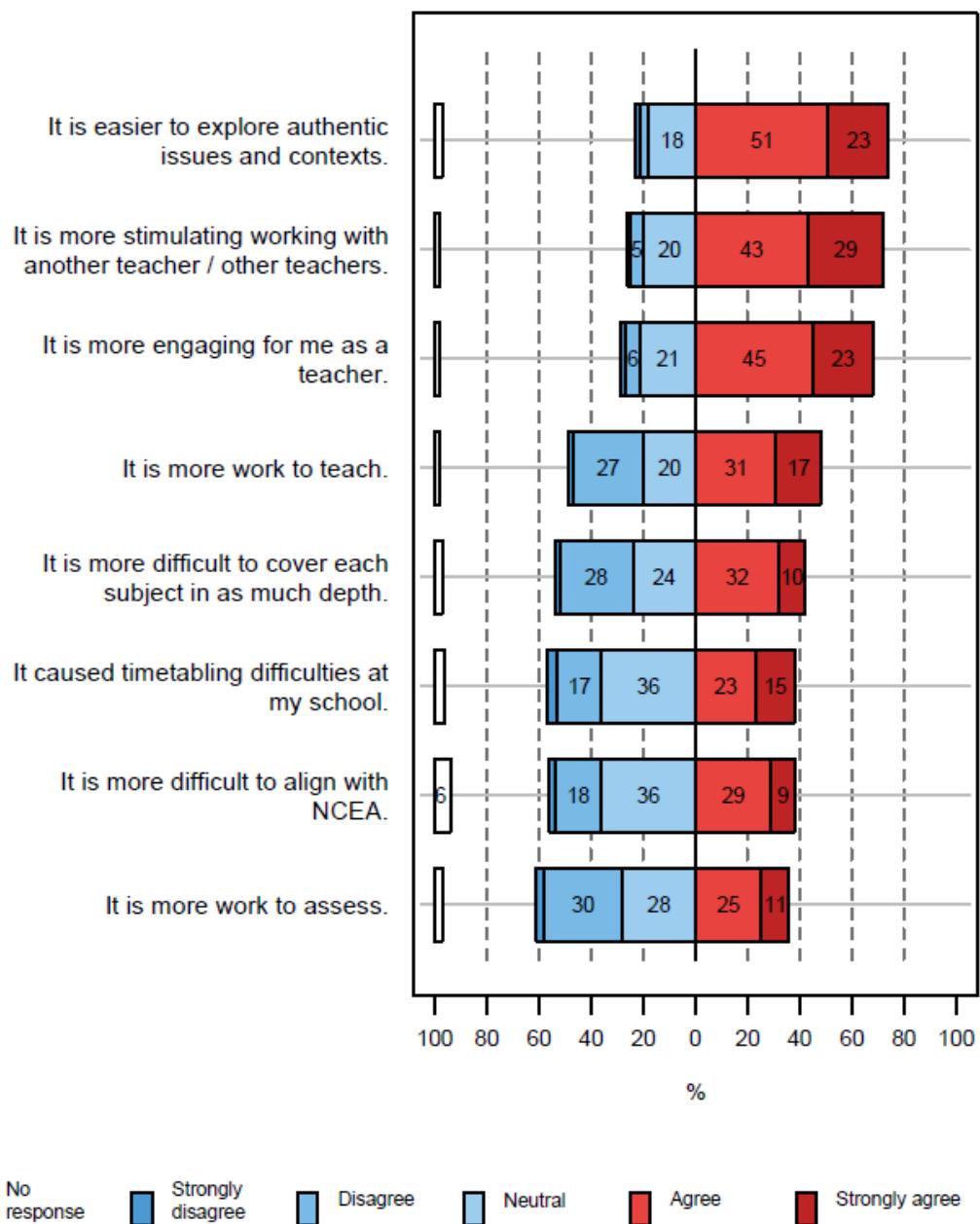
Science and mathematics teachers were more likely to agree or strongly agree that integration made it more difficult to cover subjects in depth. Across all the integration questions, this was the only difference we found related to teachers' subject expertise.

Reasons for not integrating learning areas

We turn now to responses of the 39% of principals and 70% of teachers who said they had not experienced curriculum integration in the past 3 years.

The sub-group of principals (n = 66) was asked to indicate reasons for not integrating. They were given a tick-box list and could choose as many reasons as they wanted. Table 3 shows their responses. Of the provided list, being too hard to timetable was the most frequently selected reason. In a different part of the survey, principals indicated that timetabling was a complex and tricky task: 47% of them identified timetabling to meet the needs of all their students as a major issue facing the school (Bonne & MacDonald, 2019).

Table 3 **Principals' reasons for not integrating learning areas at their school (n = 66)**

	Principals %
It is too hard to timetable	30
Subject coverage will be too superficial	23
There are no teachers interested in trialling learning area integration	17
It does not work with NCEA	15
It will be too much work to assess	5
Other reasons	55

Principals used the "other" category to write a range of explanations. The most common response, made by 20% of this group, was that their school was currently exploring, or planning for, the integration of learning areas. For 5% (n = 3) or fewer of these principals, reasons for not integrating included: scepticism about the effectiveness of integration; concerns about the impact on staff, particularly teacher workload; or that they had not considered it.

The large sub-group of teachers who had not experienced integration (n = 494) was asked why they had not been involved. They were also given a tick-box list of possible reasons and could choose as many as they wanted. Table 4 shows the results. Concern about depth of subject coverage was the most frequently selected item, followed by the perception that school leaders would not support integration. (It is not possible to directly match principal responses to those of teachers from their school, so we would not check whether this perception was supported by what a principal actually said.)

Table 4 **Reasons teachers gave for not integrating two or more learning areas (n = 491)**

Reason	Teachers who gave this reason %
I will not be able to cover the subject(s) I teach in enough depth	25
It is not supported by leaders at our school	24
It does not work for the learning areas I teach	20
It does not work with NCEA	18
It is not on the radar, or there has been no opportunity	13
I cannot find other teachers to work with on integrating learning areas	12
It will be too much work to assess	11
I am not interested in integrating learning areas	10
Other	39

Like the principals, teachers used the "other" category to give a range of responses. Eight percent said there was insufficient time for the collaboration needed. Reasons given by small numbers of teachers (fewer than 5%) included: logistical difficulties with departmental structures and/or timetable issues; not being convinced that integration would be beneficial for students; lack of expertise in other learning areas; concerns about how it would be possible to include and assess their learning area; and indications that the teacher was planning to integrate or exploring the possibility for the future.

This snapshot suggests that curriculum integration is currently a space of tentative exploration in secondary schools, with a range of questions and concerns yet to be addressed.

4. Purposes for curriculum integration

Curriculum integration has long been associated with primary school teaching and learning. The survey data confirmed that many secondary schools are also now trialling some form of curriculum integration, at least at some levels of the school. The workshops provided us with the opportunity to explore primary and secondary school teachers' *reasons* for integrating curriculum. This section outlines five main reasons given by the workshop teachers. In practice, these reasons overlap, and teachers tended to mention several of them as they gave their presentations.

Opportunities to explore relevant and authentic issues

The most frequently cited reason for integrating learning areas was to provide students with opportunities to inquire into topics that they find interesting, meaningful, and relevant to their lives and to the local and global community more generally.

> Learning needs to be relevant to students, in their current lives or future lives so that they can see the point of learning it. (Primary teacher, Auckland)

> We wanted authentic learning activities that could engage our students in problem solving and working like people do in the real world, [and to ensure] relevance, excitement, choice about what they did. (Primary teacher, Wellington)

> Learning has to be connected, authentic, and relevant to learners' lives, interests, and passions. The key point regarding the integration is that all of those contexts relate to each other. (Secondary teacher, Auckland)

> There is a danger of losing the heart of the experience [when teaching subjects in isolation]. (Secondary teacher, Christchurch)

Teachers noted that real-world problems do not come neatly packaged in learning areas, and that much of the research that occurs in the out-of-school world occurs in the "spaces between" the traditional disciplines. Further, the planet now faces problems that cannot be solved without drawing on a range of disciplinary areas, along with other forms of knowledge. Students, therefore, need opportunities to practise drawing from different learning areas to solve problems while they are at school, if they are to do so in their out-of-school lives (see the discussion below about building capabilities for 21st century learning as a purpose for integration).

Opportunities for *all* students to achieve

Some teachers said that curriculum integration enables students to more easily control the topics, processes, and directions of their own learning without being constrained by the disciplinary boundaries of a single learning area. Therefore, an integrated approach to learning made it possible to engage a wider range of students.

For example, a secondary school teacher described how the process of streaming Years 9 and 10 students resulted in students behaving according to the "labels" they had been given. This then became self-fulfilling. The bottom group tended to be disengaged and badly behaved. When they reached the senior school they were offered courses assessed with unit standards and most did not achieve an NCEA Level 2 before they left school. The school wanted all students to be motivated to learn and to feel they could succeed. They saw integration as providing that motivation, while also providing "equal opportunities" for all students to experience all the learning areas, and to achieve this fairer coverage without resorting to excessive fragmentation of the curriculum. Curriculum integration was seen as a solution to both these equity-related challenges.

Opportunities to develop "21st century learning" capabilities

Another reason given for adopting integration approaches was to provide opportunities for students to develop "21st century learning" capabilities such as collaboration and dispositions such as becoming life-long learners.

> 21st century learning skills … We want them to learn content knowledge but more than that, we want them to learn skills … Learning how to learn. (Primary teacher, Auckland)

> Ensuring our learners are ready for the future ... developing more of the capabilities, in balance with teaching and learning content. Get teachers collaborating genuinely together. More integration of learning areas. (Secondary teacher, Auckland)

> We want our learning community to be lifelong learners, capable of using all the key competencies as learning power, so they can shine in a range of contexts … The KCs [key competencies] are everything here. If our kids leave with these intact, we think they will survive. (Primary teacher, Wellington)

> I want them to have fun with learning, and I want them to be lifelong learners. (Primary teacher, Christchurch)

A related argument is that curriculum integration enables more personalised approaches to learning because not all students are required to learn the same things in the same way or at the same time. Because curriculum integration can be student driven and personalised, this argument also implies taking a culturally responsive approach to teaching and learning. One primary school teacher was explicit about this: she described how her cluster's decision to introduce an integrated STEAM (Science, Technology, Engineering, Arts, Mathematics) focus resulted from a cluster-wide inquiry and hypothesising process into the question, "How can we increase the achievement

of Māori and Pasifika students in our cluster?" She felt that curriculum integration enabled her to be more responsive to her students' interests and needs.

Opportunities to "see connections" and "go deeper"

Curriculum integration potentially provides a means for showing students how the same skill or capability could be used across multiple learning areas. For example, one primary teacher described one of her goals as "students understanding and recognising that skills in one area can be used in another area". She said, "Note-taking isn't just useful for reading and writing—it is also useful in science." Curriculum integration helped students to see these links.

> We want them to make connections between skills, for example taking skills that are stereotypically or traditionally 'maths skills' and using them in another subject area. (Primary teacher, Auckland)

This is essentially an argument about opportunities to *transfer* learning. For some teachers, seeing opportunities for transfer is closely linked to the authenticity argument: students have more opportunities to, and are also more likely to, retain and transfer the learning associated with different disciplines when working in personally meaningful, globally important, relevant, real-world contexts. A related point is that curriculum integration also frees up time in some areas to allow students to go into greater depth in others.

> Our intention was to focus on the quality of learning rather than the quantity of credits ... we also wanted to reduce the burden of external assessment ... and for students to experience early success (or to identify where there was lack of success so we could intervene earlier to support students) ... so there was a lot of thinking that went into this [redesign]. (Secondary teacher, Auckland)

As well as thinking about making deeper connnections, this comment includes a reference to the next reason for integrating—achieving greater efficiencies in both curriculum delivery and use of time.

More efficient curriculum delivery and use of time

Curriculum integration provided opportunities to use the connections between different learning areas for the purposes of developing greater *efficiency* in curriculum delivery and offering more *coherent* learning experiences. Time can be saved if, for example, components of one learning area are covered in another. One secondary teacher gave an example of a statistics unit being taught in social studies time as part of a study on census and citizenship. Another teacher described how streamlining through curriculum integration freed up time for other purposes such as mentoring students on an individual basis.

For secondary schools, efficiencies could also be achieved by linking NCEA assessments from a range of different learning areas to a common project or task. One secondary teacher carried out

an audit of how much writing the students were doing as part of NCEA assessments across all their subjects. She concluded that, "These kids are writing more than a doctoral thesis in a year with NCEA." In this context, a common task that crossed learning areas created much-needed efficiencies for students' time and efforts.

For primary schools, integrating areas such as science, social studies, health, art, and music as part of "inquiry time" was one way of dealing with the feeling of an "overcrowded curriculum", and ensuring "coverage" of many learning areas in an efficient and time-effective way. Viewing literacy teaching and learning as occurring across all learning areas could achieve similar efficiencies.

5. How schools organise for curriculum integration

In this section we turn our attention to the practical challenge of how schools organise for curriculum integration. A variety of solutions to organisational challenges are outlined. The solutions we heard are not necessarily just about combining learning areas—they often serve several curriculum or pedagogical goals in combination.

A key difference between secondary and primary settings is that primary teachers are more likely to teach a range of learning areas to the core group of students who constitute their class.[1] In theory, this should make it easier to integrate learning areas. Supporting this contention, the literature suggests that curriculum integration is more difficult in secondary schools, where different teachers have different subject expertise. The report, *Secondary Schools in 2018: Findings from the NZCER National Survey* (Bonne & MacDonald, 2019), reported that timetabling issues were a commonly cited reason for not integrating subjects in secondary schools (see Section 2). It is clear to us, however, that organising for curriculum integration entails challenges in all types of school settings.

Teachers who attended the workshops described a wide variety of ways in which structural arrangements for curriculum integration had been developed and were continuing to evolve. These range from "toe in the water" initiatives being led by one or two volunteers, to comprehensive reorganisation of the school day across entire sections of a school. A common theme in each workshop was that it is not easy to design an integrated curriculum that works as intended right from the outset. Some participants described rolling adjustments to the structural changes their schools had been making as they learnt more about what worked and what did not.

Integration that does not impact timetabling

Minimal structural change is needed when integration is achieved by organising learning around a shared learning experience that does not impact routine timetabling. In most primary schools, integration can happen within the students' main learning group, or it might involve a special out-of-class experience. One of the primary teachers explained her role in working with students from

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[1] This traditional arrangement is somewhat complicated by the development of teaching teams in larger spaces where up to three or four traditional class groups may work in changing combinations throughout the day.

different classes in the school's garden. She endeavours to integrate learning moments that arise with the planned in-class programme.

One secondary teacher described a "Big Day Out" that the school runs each term. On this day, students go somewhere away from the classroom and contributing teachers each design a specific short learning experience that relates in some way to the chosen location. Students rotate around the planned experiences.

Small-scale experimentation involving pairs of teachers

In some secondary schools, teachers of different subjects have paired up to pioneer integrated learning. The following examples were described as exploratory. They are designed to try out ideas and hopefully to open up space for more comprehensive integration models to follow. Even this limited form of experimentation requires active support from the senior leadership of the school because the timetable must be organised in a way that supports the collaboration.

Allocating a pair of teachers a class in common does not require actual structural changes to the timetable. Teachers of two different subjects collaborate to choose contexts that allow them to find common ground while continuing to use subject-specific learning activities as they work with the same class, at different times of the school day.

Creating a shared space allows pairs of teachers to collaborate more directly. In one example, the wall between two traditional classrooms was removed to facilitate a trial of integration, led by one pair of volunteer teachers. They were allocated a class in common, then planned and co-taught units that integrated aspects of their two subjects. The teachers involved described this as an exploration of working in shared spaces as much as it was an exploration of integration per se.

Creating an integration strand within the larger timetable

In some secondary schools, several pairs of teachers worked together within a strand of the timetable that had been specifically adapted to support experimentation with integration. This is a more complex type of change and it was in these cases that we began to hear accounts of rolling experimentation and adjustments as teachers learn from experience.

Creating an integrated Year 9 strand, staffed by a small initial team, is possible within the larger timetable structure of a big, traditional[2] secondary school. One case we heard about involved collapsing five Year 9 classes into four, each made up of 30 to 40 students with a pair of teachers. Each group gets 4 hours of teaching time per week—1 hour for mentoring and 3 for teaching. Each pair of teachers has chosen a context to develop as a term's integrated learning and each Year 9 class within the integration strand rotates through the various pairs. This means that

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[2] "Traditional" here means the school has single classroom spaces, not more open learning environments.

each pair of teachers gets to teach their unit four times across the course of the year, refining it as they go. They can team teach, or take turns, depending on what is happening at the time. The aim is to build a strong experience base with the volunteer teachers in 2019 and roll the integrated programme out across the whole of Year 9 in 2020. The teacher who introduced this example explained that they were exploring more efficient ways to deliver the necessary breadth of a Year 9 curriculum.

Working as an inquiry team allowed a group of teachers in a low decile secondary school to explore the idea of a place-based curriculum (PBC) that would be more engaging for their students. The exploration was funded as a TLIF[3] project. They wanted to create integrated learning experiences to maximise learning opportunities in local contexts. It took several years of inquiry to get a workable structure that would allow them to realise this vision. The larger learning groups they initially tried were not successful because teachers struggled to establish strong learning relationships with students. They determined that two teachers per student group was a workable unit size. In the third year of the project, the PBC teachers formed two teams of four. Each team comprised an English, maths, science, and social studies teacher who were timetabled to teach the same classes of Year 9 and Year 10 students. In pairs within their group they designed and delivered placed-based integrated learning experiences. In any one period, only one of the pair of teachers was with the class. This meant that they needed to plan very carefully so that the learning would be coherent for the students. It sometimes meant that the teachers needed to work in each other's learning area. The inquiry team found that maths and science made a strong pairing, as did English and social studies. For the year following the completion of the TLIF project they restricted curriculum integration to these "natural" pairs of subjects.

Integrating learning for whole cohorts

Whole-cohort integration in traditional schools typically begins at Year 9. If this is deemed successful, the changes might transfer to Year 10 in the following year. We heard of several cases of further expansion into Year 11. Newly established schools usually grow by one cohort at a time: Year 9 in the foundation year, Years 9 and 10 the next year, and so on. In these new schools, curriculum integration often goes hand in hand with innovative building design: larger learning spaces allow for larger learning groups working with two or more teachers at a time. Notwithstanding the careful advance planning that can happen when new schools open, the need for further structural changes can become evident as teachers learn from experience. As in the case of the place-based inquiry outlined above, staff/student ratios have proved tricky to get right. The examples that follow are variants on this general outline.

Restructuring the entire Year 9 and Year 10 curriculum has radically changed learning for students in one smaller secondary school. Students study 12 courses during the year (six each semester), chosen from a total offering of 57 courses in 2018. There is no differentiation between

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3   Teacher Led innovation Fund.

Year 9 and Year 10. Students from either year can choose any course and they work together in class. Some (but not all) courses integrate two learning areas within the course focus and theme. A teacher offering such a course needs to be able to teach in both learning areas.

Integration at Year 11 has followed on from sequential integration at Years 9 and 10 in one low decile secondary school. The timetable has been reworked so that in each 12-week trimester students choose up to five short courses, and also undertake two inquiry projects and three "passion projects". A design principle for each short course is that it has to be "connected, authentic and relevant" to students' lives. Judicious choice is made of Level 1 NCEA achievement standards that support the integration theme, so that assessment is not as burdensome as in the past.

Making rolling adjustments proved necessary in one new secondary school. In the foundation year, the Year 9 cohort was organised as four classes of 50 to 60 students in one space, with four to five teachers from across a range of core subjects. In the second year, the same structure was retained, multiplied by two to accommodate both Year 9 and Year 10 cohorts. Building and maintaining strong relationships with students emerged as one major challenge. The specialist teachers were "wanted in both places at once" (i.e., both Year 9 and Year 10 classes) and did not have the chance to establish strong relationships with either cohort. The teachers found that student engagement fell and they reverted to using assessment as the driver and motivator. In the third year, the school has gone back to a model more like the first year—each group of 60 students will have a core group of three teachers who stay together and stay with them.

Structuring for comprehensive whole-school integration

In our sample, examples of whole-school integration all came from newly established secondary schools. One of the participating schools has now experienced an entire cohort arrive in Year 9 and leave in Year 13. Another new school enrolled full cohorts of students across all year levels from the very first year, in contrast to the rolling growth described above.

Choices are structured to meet students' learning needs flexibly in one new secondary school. The curriculum structure has evolved as the school has grown cohort by cohort. Integrated modules are created by two teachers from different subject areas who work together to develop appropriate curriculum learning within a specific context. These integrated modules are complemented by single subject modules taught by one teacher. Students also complete individual inquiry projects. Table 5 below summarises the way these structures combine to create flexiblity and choice, with the mix gradually changing to accommodate the emphasis on gaining qualificaitons in the final years of schooling.

Table 5 **Ways of organising integration at different levels in one secondary school**

Foundation (Years 9 and 10)	Three integrated modules per semester; three single-subject modules per term
Qualification 1	Two integrated modules per semester; two single-subject modules per semester
Qualification 2	One integrated module per year; three single-subject modules per year
Qualification 3	Four to five single-subject modules per year

A radically different timetable structure in one new secondary school consists of three main strands: a strand where learning is integrated around a specific overarching context that acts as a "spark" for the subsequent learning; a strand in which students work on inquiries in individual areas of interest, approaching specialist teachers for help as needed; and a mentoring and pastoral strand where each student is assigned a teacher who has oversight of their whole learning programme and progress. Four "sparks" run in each timetable block, each led by two teachers and lasting 6 weeks. Years 7–13 are organised as one cohort for the purposes of making choices and hence students often work together across age groups. However, more depth in their individual projects is expected from older students. Their mentor teacher will work with them to ensure that this happens and to check that Year 13 students will have achieved a mix of achievement standards that allows them to gain both NCEA Level 3 and University Entrance (UE).[4]

In 2018, the school experienced a problematic disconnect between the mentoring strand and the integrated (sparks) strand because individual mentor teachers were expected to help students design and carry out inquiry projects related to sparks that covered contexts and curriculum that they had not personally designed. In 2019, the school was planning to allow a longer set of curriculum blocks for each integrated unit, making space within the unit for initial personal project planning. The intention was that the teachers who designed the unit should have more say about how subsequent learning unfolds and will presumably be the ones with the motivation to track how individual projects are going.

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[4]   Level 3 NCEA requires 60 credits from across any combination of achievement and/or unit standards. However, in order to also gain UE, credits must be attained from a small number of coherent subject combinations, which means that their distribution across "approved subjects" needs to be carefully tracked.

6. Thinking about subjects and knowledge

In this section we discuss teachers' thinking about the integration of specific subjects, and how best to introduce and build subject-specific knowledge in an integrated unit of learning. These are challenging aspects of curriculum integration. Many interesting questions came up in the focus group conversations. For example, which subjects lend themselves to integration and why? Do some subjects serve specific purposes that others don't? How and when should knowledge from different learning areas be introduced into an integrated unit? This section is organised along the lines of these big questions.

Which subjects lend themselves to integration and why?

Teachers across the three workshops described the integration of different combinations of subjects. The subjects most frequently integrated were associated with the humanities and social sciences, including English, the arts, and social studies.

The subjects that teachers least frequently integrated were maths and, to a lesser degree, science. They said that they needed to teach concepts in a certain order in these subjects. The hierarchical nature of the knowledge in these learning areas is implicit in this argument, albeit typically expressed by using phrases such as "logical order" or "foundational content". The following comments are indicative of this view:

> The only one that doesn't fit [an integrated approach] is maths because there are quite specific foundational skills that we want to hand to them. If we did integrate the maths they would get a bit more lost … It is easier to plan the teaching and easier to track students' progress [when we teach mathematics separately]. (Primary teacher, Wellington).

> Some faculties have pushed for a more prescribed and planned curriculum in their subjects, asserting the importance of building disciplinary knowledge in those subjects (particularly science and mathematics). They say there is a logical order to teach these things and you can't just go randomly jumping in and out. English and social studies have usually been easier to integrate. (Secondary teacher, Wellington)

At some schools, teachers had *started* by integrating maths and science with other subjects, only to subsequently return to teaching them separately. For example, one secondary teacher observed that maths was included when curriculum integration was first introduced in Year 9, but when curriculum integration was extended to Year 10 as well as Year 9, it became too difficult.

> Some subject areas coped with this scaling up, but others struggled … Maths teachers struggled, particularly with the difference between mathematics and numeracy. (Secondary teacher, Christchurch)

Integrating mathematics in an authentic, rather than contrived way was another challenge again.

> Maths doesn't usually fit ... Sometimes we push it a little bit—it gets a bit silly. (Primary teacher, Wellington)

> The teachers have struggled to integrate mathematics into inquiry units. They don't want the learning to be too contrived and so they have tended to keep it separate. (Primary teacher, Wellington)

One of the secondary school teachers made a similar observation in relation to integrating physics with other subjects. He described how he was part of the team that delivered a unit on "risk". He was asked to "chuck in some physics" but the anticipated content was not actually about risk per se—hence he saw this as a token connection.

Teachers' thinking about the relative ease or difficulty of integrating subjects was impacted by their own levels of confidence in and knowledge about the subjects being brought together. Contrary to the thinking of other participants, one primary school teacher saw maths as her strength and considered it the easiest subject to integrate. She said she could easily identify opportunities for mathematics teaching with other curriculum areas.

> Maths is really easy to integrate with art because in art there are a lot of repeating patterns and shapes. Maths is easy to integrate with science because there's a lot of similarities with graphs. (Primary school, Auckland)

This teacher worked with 5- and 6-year-olds, raising the question of whether it is easier to integrate learning areas at the lower levels of the schooling system.

A dissemination role for English and the arts

We often heard about instances where English and the arts were integrated, mainly for dissemination purposes. In these cases, the learning focus was situated in one subject, such as science or social studies, and then students could present what they had learnt through English and the arts in a "celebration of learning". For example, one secondary school offered an integrated unit in which students chose the form in which they presented their understanding of a social issue of their own choice. One group wrote a script for a graphic novel about homosexual law reform; another group wrote a play that was then performed by members of the class. At one primary school, students could present their social studies learning through a speech, dance, song, rap, model, poster, or a play.

There is great potential here for students to learn more about the similarities and differences of the learning areas and what their different meaning-making tools can be used for, as they choose from a range of presentation options. But these need to be explicitly taught *for*. And the extent to which the students experienced explicit instruction, modelling, or scaffolding in the knowledge, discourses, and practices of the "dissemination" subjects varied, as did the amount of actual integration between the learning areas concerned.

There is also the potential for building new knowledge by bringing together or juxtaposing the discourses, practices, and knowledges of different disciplines in new and creative ways. But, again, there are risks—specifically that the knowledge, discourses, and practices of either one or both disciplines become confused in students' minds, disappear, or become diluted to the extent that their usefulness to solve problems in the world is reduced.

At some schools, teachers maximised the potential and minimised the risk by providing students with opportunities to learn the knowledge, discourses, and practices of the core learning area, *and* those associated with the discipline in which they were working to present their learning. For example, at one primary school, the teachers responded to students' choice of dissemination mode by bringing in members of the community with the appropriate expertise to assist students in learning the knowledge, discourses, and practices they needed to present their learning in ways consistent with the discipline in which their dissemination mode belonged.

Another primary school framed the focus to *ensure* that students need to think about one subject in the context of another, and specifically about the nature of the subjects being integrated. One opportunity arose as students responded to a generic inquiry question: "How do we inquire into a problem that we feel passionate about?" Some of the inquiries students carried out were: "How do we share information and ideas about our Samoan and Pākehā cultures through a drama?"; "How do we share a positive message and important information about wellbeing with our community through dance?"; "How do we share information about New Zealand with Syrians and make them feel welcome through music?"

The treatment of knowledge in an integrated unit

Teachers were on a continuum in their views about the importance of disciplinary knowledge in the curriculum. For some, opportunities to develop capabilities, competencies, or dispositions were as, if not more, important than disciplinary knowledge.

> You can get them to get the grades … They can just regurgitate, but if you want them to think … (Secondary teacher, Wellington)

> That comes down to your planning throughout the year … but that's with everything, isn't it? If you are following your kids and giving them agency … It's a trade-off. It's what you value and what your kids value. If they come out of it wanting to learn more … (Primary teacher, Christchurch)

> It is tricky to balance the imperative to foster students' agency to inquire and discover, versus the need to expand their horizons by introducing them to things they don't yet know. (Primary teacher, Wellington)

For others, knowledge retained high importance and opportunities to learn disciplinary knowledge during integrated units of work were front and foremost.

> When you integrate a curriculum, that specialist knowledge is really important and you need to maintain that. (Secondary teacher, Christchurch)

> [It is important not] to get carried away with the context and forget the learning that sits inside. (Secondary teacher, Auckland)

The need to support students' conceptual growth, as well as their agency, was seen by some as particularly important for students whose home knowledge differed most from school knowledge.

> I believe we are trained to be teachers to introduce children to a world they haven't met. They don't know everything—they have wonderful creative questions, but *we* can open gates and doors. Particularly in our community we have children … who don't do a whole bunch of things. On the other hand, they do a whole bunch of *other* things. So, it's *seeing* those kids. (Primary teacher, Wellington)

When is knowledge best introduced?

The need for curriculum coverage is in tension with the idea of student-directed inquiry. Teachers described "pre- or front-loading knowledge" to set students up to carry out explorations and investigations of their own. This was usually accomplished by using more traditional instruction approaches before allowing students to pursue inquiries that involved more than one learning area.

> Teachers often begin with 'front-loading' content before the project phase begins. (Secondary teacher, Christchurch)

> Sometimes you've got to pre-load the knowledge. Other times you kind of discover it as you go and then make the connection really explicit to the kids. (Primary teacher, Christchurch)

This pre-loading sometimes happened in separate learning areas. In some secondary schools, different teachers covered knowledge in their subject and students then had opportunities to integrate and apply knowledge from all these linked subjects in subsequent project time. A teacher heading a STEAM integration initiative from one secondary school described this type of arrangement. The students acquired skills and knowledge in the different learning areas then worked as a larger group on a shared project that involved some form of practical application. To ensure that all students covered the areas of STEAM subjects that staff considered important, they were given some compulsory topics as well as some topics to choose from. In Year 10, students did the same core subjects as those in mainstream classes in the school and then had two project options: kinetic sculptures (drawing on knowledge from art, maths, and science); and future tech, in which students designed their own projects around the use of specified tools or topics (such as 3D printing, laser cutting, game design, augmented reality, and app development). These future tech projects were outward looking and community focused in nature.

Sometimes, pre-loading in one subject starts a unit off and then content from the different learning areas is introduced more sequentially. For example, a science teacher described beginning an integrated science and technology unit that addressed the question: "Is there a future for fossil-

fuelled personal transport?" The unit began with "reasonably traditional lab teaching" about the use of carbon compounds as fuels and included some structured investigations (collecting particulates from air near the roadside, burning samples of different fuels; for example, petrol and diesel). Secondary data analysis was also included, looking at impacts on human health and changes to carbon in the atmosphere. "Then we said, right, now you've got to use all this knoweldge as part of your bigger project." At this stage they moved into the technology component of the unit and students explored technological solutions to some of the issues raised (e.g., fuel-based and electric vehicle technologies). They worked alternately on their technology build and the carbon chemistry components of the programme. The teacher hoped that this allowed students to see "how these two things mesh together, because the electric vehicle thing is the solution to the implications of the carbon compounds [issues]" and "they will see this shift [in vehicle technologies] in their lifetime".

A third example of pre-loading came from a primary school with a culturally, linguistically, and socioeconomically diverse student population. The teacher described beginning a unit on "What makes a real-life hero?" by teaching students about Martin Luther King—a person who "only about two of the 92 students had ever heard of". The children then had the opportunity to identify and research their own "real-life hero" and to present their learning to others through a wide range of means such as making plays, sculptures, monuments, speeches, music, or artworks. The teacher considered that it was this *combination* of explicit instruction, and opportunities to explore that accounted for the rich and deep learning outcomes teachers observed in the students. Students had opportunities to learn important social sciences concepts in a teacher-directed way before being given opportunities to transfer and apply them to new contexts.

> They explored big concepts like racial segregation and racial tension as you'd expect; they understood courage and impact; they were inspired to *look* for real life heroes, to *be* them. (primary teacher, Wellington)

One of the challenges of the pre-loading approach to the inclusion of knowledge is that, if there is genuine student-led inquiry, it is difficult for teachers to determine ahead of time all the knowledge students may need to know, and it is likely to differ for different students. It is for this reason that teachers from other schools had chosen a "just-in-time teaching" approach to knowledge.

Challenges of "just-in-time" approaches

A just-in-time approach often involved the provision of mini lessons, using explicit teaching, as and when specific knowledge was needed by groups or individual students. Teachers who used this solution considered that what, when, and how best to feed in the knowledge needed was one of the most challenging aspects of integrating curriculum, especially given that students are not all working at the same conceptual level. This challenge shines a spotlight on the demand placed on teachers' own knowledge—both content knowledge and pedagogical content knowledge (e.g., recognising the "teachable moment" and making on-the-spot decisions about how best to respond). We return to the demands placed on teachers' knowledge in the next section.

Keeping track of the knowledge introduced in this way is also challenging. At some schools, teachers had developed systems of planning that ensured they could track curriculum coverage. For example, one middle school teacher described how teachers at her school work together in their whānau groups to plan learning around "authentic contexts" chosen with input from the students. There are no pre-written schemes—they plan as they go. As the envisaged learning unfolds in real time, they update the Moodle planning tool on a weekly basis. Inbuilt features of the tool help them to do this quickly and efficiently. Once the data about the achievement objectives that have been addressed have been entered, the program can create a mapping of wider curriculum links for later analysis and to identify gaps.

Maintaining a focus on disciplinary practices

Providing opportunities to learn the discourses and practices of a discipline is a challenge for both pre-loading and just-in-time approaches to the introduction of relevant knowledge. Some workshop teachers described helping students to understand the differences between different disciplines by looking at an inquiry question, concept, or topic from the perspectives of several different disciplines.

> We think about and see the same concept from different [disciplinary] perspectives. (Primary teacher, Wellington)

This comment was made in the context of exploring "action-reaction" ideas. In another example, a primary school teacher described an inquiry in which Years 5–6 children were exploring the building of a self-sustaining home. She supported students to talk about the differences between an artistic drawing and a scientific diagram when they began designing terrariums and bird houses. A secondary school teacher described how she made explicit to students the way the same text might be used for different purposes and in different ways depending on the learning area:

> I'd say things like, 'This is how we use it in geography', or 'This is what historians would use it for'. It's just making those links. It's just a couple of sentences. (Secondary teacher, Christchurch)

One primary school teacher gave an example of the confusion that can arise when students are not aware of differences between disciplines. The class was working on the science component of an inquiry into the work of palaeontologists. His Year 2 and Year 3 students began to use their imaginations in *creative narrative* rather than *scientific* ways to hypothesise that things they observed in their school environment (such as marks on tree trunks, broken branches, and "bitten" in half leaves) had been caused by a dinosaur before it died. They were using their understanding of the knowledge, discourses, and practices of story tellers, rather than of scientists. This is not surprising given that the texts young children most often encounter are narrative fiction.

Being explicit about the nature of different disciplines involved drawing attention to *similarities* as well as differences. For example, one primary school teacher described being very explicit with students when doing a hands-on science activity that involved literacy skills that she had previously taught. She made the links clear by saying things like:

'Oh, you did some note-taking right there. You did that in science—see how these skills relate to each other', or 'Look how you're recording your data in a table, like you would in maths, but it's also useful in science'. (Primary teacher, Auckland)

A place for "local" knowledge in an integrated unit

Once students have grasped the understanding that there are different types of knowledge, space has been created for other forms of knowledge to be considered alongside disciplinary knowledge. We end this section with a discussion of opportunities to introduce other voices and ways of knowing into the classroom. These opportunities are not restricted to integrated units of course, but, as the next example illustrates, authentic contexts can create a space where community expertise complements and enhances the knowledge of the teacher and the students.

One primary teacher described an integrated unit centred on the theme of "water". This theme permeated a range of activities that allowed students to experience how the water behaves. It also included narratives negotiated with the local iwi. Another unit centred on building a garden at the school. The teacher described the garden as a space where members of the community are welcome because, "It benefits us when outsiders come in". There have been donations from the community and local businesses in the form of wood, plants, and mulch. There are signs to indicate which parts of the garden are for sharing with the community and which parts are not.

Teachers face the challenge of making links between disciplinary knowledge and community knowledge, just as they must make links between disciplinary knowledge and students' knowledge. The advantage of this type of meta-teaching is that other knowledge systems can be considered. This is not to say one form of knowledge is better than the other, but students do need to learn that they are not the same *kinds* of knowledge, which takes us back to the challenge of being explicit about the discourses and practices of different disciplines, and different ways of knowing.

Some of the secondary teachers in our study were able to address this challenge using collaboration between teachers of the different learning areas concerned as experts. Each teacher contributed knowledge from their discipline pertinent to the inquiry at hand. These experts could be consulted as needed by students at various points in the project. At other schools, teachers brought in experts from the community to fulfil this function. In some primary cases, teachers went into role as disciplinary experts, using a "Mantle of the Expert" (Fraser et al., 2013) approach. For example, at the primary school where students were learning about palaeontology the teachers arranged for an adult external to the school to take on the role of a palaeontologist. This person wrote letters to the children and spoke to them via video clip to input knowledge and to clear up misconceptions, as the need arose. The advantage of such approaches is that the expert can "represent" a discipline. By being or acting in a certain role associated with that discipline, they help maintain its fidelity as the relevant knowledge is being used to help address a multidisciplinary problem or question.

7. Dynamics of teacher knowledge growth

Section 6 raised the challenge of the considerable knowledge demands that curriculum integration can place on teachers. For example, one primary school teacher described the importance of alerting students to disciplinary and cross-disciplinary connections that occur incidentally in the process of teaching and learning so that these are "really explicit to the kids". Doing this successfully is obviously dependent on the *teachers*' knowledge of different learning areas and the connections that could be made between them. She talked about the risk posed by blind-spots, asking, "How do you know what you don't know?"

In this section we explore ways teachers strengthen their knowledge to meet the challenges they face as they bring learning areas together. The dynamics of their personal knowledge growth became apparent in different ways. As we first discuss, sometimes professional learning with another initial purpose could trigger a desire to explore curriculum integration, not the other way around.

Raising awareness of discourse communities

Professional learning that introduces teachers to the knowledge-building practices of one discipline area can have a powerful impact on how they think about their practice more generally. We found two different examples where raising awareness of knowledge-building in one discipline prompted teachers to think about transfer to another learning area, and thence to explore possibilities for curriculum integration.

DMIC: Developing mathematical inquiry communities

One Wellington primary school provided students with opportunities to move in and out of what could be described as apprentice discourse communities. Groups of students worked together to solve complex challenges pertinent to their class inquiry. As students worked together in these communities, they were encouraged to use the knowledge, discourses, and practices of the discipline, and take on the identities of, for example, scientists and mathematicians. Students at this school had many opportunities to engage in such communities around single-subject inquiries as well as integrated ones.

The school first adopted this approach through their work with Roberta and Jodie Hunter on DMIC (Developing mathematical inquiry communities) maths. In the DMIC maths model, students work in mixed-ability groups of four to solve challenging mathematics problems. Through working in what are essentially apprentice mathematics discourse communities the students learn, among other things, about the discourses and practices of mathematics and so the students begin to see themselves as mathematicians. As the teacher from this school observed:

> Our kids see themselves as mathematicians. They can talk about their 'maths smarts', for example it could be that they are good at 'friendly arguing' or strong on 'fact knowledge'. (primary teacher, Wellington)

The teachers then transferred these ideas to other learning areas, describing how the DMIC model "has become part of what we do across the curriculum". They found that, as a result, their students began to take on disciplinary-related identities; for example, "as artists, engineers, or mathematicians".

The teachers now use this approach for units integrated around big questions, which helps them keep an eye on, and keep clear/front of mind for students the nature of the different disciplines being integrated.

Science leadership programme

An Auckland primary school teacher said she did not start out with a science background. Over a few years she "went on a big learning curve" that included taking part in the science teaching leadership programme facilitated by the Royal Society. This programme has a focus on a small set of "science capabilities" that focus on the knowledge-building practices of science. The teacher noted that she "had the luxury of six months out for thinking [during the science leadership course]; they [other staff] haven't had that luxury". As part of her leadership of science learning in her school, she is now responsible for leading the integration of science with other learning areas. As in the case of DMIC, sustained knowledge-building in one learning area provided the impetus and confidence for curriculum integration further down the track.

Building content knowledge across multiple learning areas

In the focus groups, some teachers did describe providing students with opportunities to build the knowledge, discourses, and practices of the learning areas being integrated. These tended to be teachers who already had deep content knowledge across at least two of the areas being integrated or who had set up processes that enabled them to quickly build this knowledge. One secondary teacher had taught in several learning areas: social studies; English; history; and outdoor education. She had also worked as a professional learning and development (PLD) facilitator, working in both primary and secondary schools. This experience provided opportunities to observe different approaches to curriculum across these two sectors. This teacher understood the similarities and differences of multiple learning areas, which helped in the design and delivery of integrated units of work.

Most teachers don't have the sorts of diverse opportunities just described but working collaboratively on an integrated unit can be a useful proxy. Planning together can help expand teachers' knowledge in various ways.

One primary school described a planning process that begins in Term 4. All the teachers work on a "Year Overview Map". They decide on the concepts that will drive the integration process in the following year, and then identify a range of contexts in which these concepts could be explored.

This leads to a mapping of learning area achievement objectives that will fit. Teachers then decide which planning team they want to join as they work collaboratively to expand the ideas. Every term, each team designs one inquiry unit for everyone to use. As they work together, they look at the different levels/learning needs of students and have "deep discussions" about how the unit might unfold, adapt, and change in different learning contexts and at different curriculum levels. In this way, over time, expertise is shared and built across the whole staff.

One middle school leader described how the teachers in each of the school's four whānau groups plan each integrated unit as a collective. Even though they then teach individually in the areas of their own subject expertise, they have an overview of the whole unit which helps them to make connections where relevant.

One primary school cluster has been exploring integration of STEAM subjects via play-based, hands-on inquiry experiences. The actual integration takes place in each individual classroom but, with the support of TLIF funding, peer coaching has been used to help all the teachers in the group "get up to speed on content knowledge". Six co-designed inquiry tasks have created common ground, which means that each time the cluster meets the teachers have opportunities to share what has worked. They can also ask for advice and support when they have encountered challenges.

In a small secondary school, all Year 9 and Year 10 courses are contextually based, and in some cases integrate two subjects. Teachers worked to their personal strengths when they first began to design these units and the process was much easier for those who had expertise in two or more subjects. However, as experience of the changed curriculum has grown, so has collaboration around planning of new units. More teachers are now combining their expertise as creative new units are designed, even though ultimately only one of them will teach the course.

Another way in which teachers might collaborate to deepen their expertise involves the development of shared meta-concepts that transcend individual learning areas, and to which the different subjects make complementary contributions. Examples we heard about included contrasting the ways that evidence is used in different disciplines and exploring what perspective-taking looks like in diverse contexts. Teachers are likely to draw on ideas from the front part of *The New Zealand Curriculum* (Ministry of Education, 2007)—for example, developing aspects of key competencies and/or values explorations—as they identify shared meta-concepts that will apply to their individual learning areas.

If the collaboration extends to co-teaching of the unit, teachers have opportunities to observe the teaching of "content" that is initially outside their own areas of expertise. Pairs of teachers who reported such examples said they had gained new insights into each other's learning area as the planned learning unfolded. In one secondary school, the teachers take part in a "speed dating" process each year. The objective of rotating through a series of fast-paced interactions is to identify shared interests and potential subject synergies within the contexts being discussed. After this process, teachers provide the curriculum team with their top preferences for partnerships. It is

up to the smaller team to juggle the various wishes to ensure every teacher has opportunities to work to their passions and strengths, and to experience rich collegiality in the co-taught integrated units they will go on to design. The school leader who shared this example said that the process has generated some pairings and themes that might not ever have surfaced during routine professional conversations.

Building pedagogical content knowledge (PCK)

Teachers can deepen their PCK when they have opportunities to observe more experienced peers in action. For example, when a teacher with greater expertise identifies sticking points in learning and works to help students overcome these, the teacher who is observing might expand their awareness of these challenges and how to address them. Such opportunities are not unique to integrated learning, but this is one way in which they can be "business as usual" rather than requiring a specific episode of observation to be organised.

Integrated units of work often centre on student inquiry. This is another area where we heard about teachers expanding their PCK as they worked together. Learning often involved building deeper knowledge of aspects of inquiry capabilities that need to be actively taught. Some teachers had previously thought such capabilities would develop experientially. Observing more deliberate teaching gave them concrete ideas about what they could do differently in future.

Expanding professional knowledge in the area of assessment

Secondary teachers in one school were exploring integration in a TLIF-funded project. They found that they needed to design new types of assessment tasks to reflect the more authentic, problem-based learning that emerged in their collaboratively designed units. One of the leaders of this team noted that the new assessment tasks were far more demanding than traditional knowledge tests, and yet many students were achieving at higher levels than in traditional classes. This pattern of enhanced achievement can also result in a need for assessment rubrics to be co-constructed with students, rather than being prepared and published in advance. The teacher said they were learning more about what students were capable of, and so were the students themselves.

Developing an integrated programme in the senior secondary school might provide opportunities for teachers to expand their understanding of the scope of NCEA achievement standards. One teacher said this happened when he and another teacher brought fresh perspectives to NCEA standards in each other's learning area. This collaboration was necessary because they planned to design one summative task to assess both learning areas. As they questioned each other on what might be possible and why, their understanding of the scope of their own achievement standards also grew.

This teacher also noted that some early career teachers were actually looking closely at the full scope of achievement standards for the first time. Previously, they were likely to have been allocated a topic, with a pre-designed assessment task for a specific achievement standard.

Someone more experienced in the team had done the designing so they did not necessarily see a need to explore the standards in depth. Again, co-design of integrated assessments provided opportunities to bring "fresh eyes" and new thinking to the scope of what might be possible in summative assessment tasks.

Building PCK across sectors

In two of the three focus groups, teachers talked about the value of having secondary and primary school teachers swapping classes to see what integrated teaching and learning looks like in a different sector. One group talked about the value of having secondary school teachers, with their disciplinary specialisation, work alongside primary school teachers, with their child-centred approach to teaching and learning and their experience of working more fluidly across disciplinary boundaries.

8.   Approaches to assessment

Many teachers considered assessment to be one of the main challenges in their attempts to deliver an integrated curriculum. In this section we outline the range of approaches to assessment we heard about across the three teacher workshops.

Releasing the pressure to formally assess

Some schools chose not to formally assess learning outcomes while trialling their new approaches. The leaders at these schools wanted to "free teachers up" to take risks and experiment in the teaching and learning space without feeling constrained by the need to assess. For this reason, one secondary school had chosen not to use NCEA to formally assess students in Years 9 and 10.

A primary school leader talked about "releasing the pressure to assess". By this she meant giving the teachers permission to focus on teaching and learning. One reason for this reluctance to assess integrated units was that the school did not want to narrow the rich learning taking place by trying to capture it with tools that were not sophisticated enough to describe such learning.

> We're seeing it [student learning], and we're feeling it, and we *know* it, but we don't have the documents that *track* it. And, at the moment, I'm putting a stick in the sand and saying, 'That's fine'. It's transformation. How do I measure what's most important from [the] Martin Luther King inspiration? You're a changed person because now you know that you want to be a real-life hero. How do I measure *that*? So, it's identifying what's most important to whom. (Primary teacher, Wellington)

Assessing for knowledge using standardised assessments

At some schools (often secondary schools), teachers had decided to continue with traditional assessment alongside their new integrated approaches to teaching and learning. In other words, they assessed the integrated learning areas separately. The assessments typically focused on declarative knowledge, as they would have when the learning areas were taught separately. They said that lack of availability of different assessment tools was why they did this. They noted the relative ease of assessing declarative knowledge with traditional tools. This more traditional approach seemed to work well as a first step for schools that wanted to try a new approach to teaching and learning but were not yet ready to broaden their approaches to assessment.

The disadvantage of only taking a traditional approach to assessment is that there can be a lack of alignment between objectives for teaching and learning, and what the assessment captures. Some

of the secondary teachers in the workshops expressed an awareness of this. They commented on the inability of more traditional assessments to capture shifts in students' capabilities, which they considered to be an important purpose for taking an integrated approach to teaching and learning in the first place.

For example, the secondary school teacher leading a STEAM initiative in her school observed that assessment of project work needs to be about the process, as much as the product. She said they had not yet found a credible way to assess the process, though, as we note shortly, they have been trying.

Another secondary school teacher noted that teachers who were already experimenting with integration were "still using quite traditional assessments". At the time of the workshops this school was planning a more concerted focus on changing assessment practices. In the following year all the teachers would be expected to assess and report on students' development of the named set of school skills[5] as well as their subject-based learning. The curriculum team has not yet worked out exactly *how* this aspect of assessment will happen. It is work in progress.

Assessing for capabilities, competencies, or dispositions

At other schools (largely primary schools) teachers chose to focus on capabilities, competencies, or dispositions when assessing integrated units of work—often because they saw these as *common* across the learning areas being integrated. However, they found working out *how* to assess for capabilities or dispositions to be challenging, asking questions such as: "*What* do we measure?"; "Can you measure engagement?"; or "How do you measure transfer?" In the face of the hard-to-assess nature of capabilities or dispositions, these teachers tended to use student self- and peer-assessment, learning stories, or unit-specific rubrics for assessment.

For example, one of the primary school teachers responsible for a school garden space, where a lot of integrated learning happened, described how the school uses learning narratives to assess for dispositions. The narratives are posted on a shared site so that she can see what the children have been working on in their other classes. She can also post stories of the developing dispositions she observes in the garden space on the site. She can support the learning goals set by other teachers with each child and put her own learning goals into these narratives. Another primary teacher described how her school uses "the early childhood model of assessment" with students writing learning stories about their work and their achievement against the success criteria they had input into developing. Peers could give feedback about students' learning stories and so could parents.

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[5] The development of these was based on the front part of *The New Zealand Curriculum* (Ministry of Education, 2007). The seven skills are: positive attitude; communication; team work; self-management; willingness to learn; thinking skills; and resilience. Each skill is unpacked in four "I am …" statements designed for self-assessment.

A primary school teacher from a third school described a range of approaches teachers had used for assessing capabilities including teacher observation, anecdotal notes, videos, and using See Saw to share with parents what was happening in school.

The secondary school teacher leading the STEAM initiative described their attempts to assess the process of student work, not just the product. Currently, the STEAM students keep reflection logs, but they are assessed on their skills for English and social studies in the same way that the other non-STEAM students are assessed. Working out how to assess the science component of the community projects was challenging. The solution had been to develop a rubric based on the SOLO taxonomy to assess collaboration. The team had also used a "Dragons Den" approach—bringing in industry experts to be the judges of final projects, also using criteria based on the SOLO taxonomy.

A secondary teacher at a different school said that they are still working out how to assess the "capabilities" aspects of students' learning. Currently, they use self-assessment. At the end of the term, students select one piece of their work, describe the key competency demonstrated and their next step in developing that competency. The teachers are still working out whether they will add peer validation to this process.

One of the risks of assessing for competencies, capabilities, or dispositions across several learning areas is that the discipline-specific nature of competencies and capabilities can be overlooked. A competency like thinking or relating to others can be treated as being the same for science and English, when in fact, while there are similarities in the ways in which scientists and literary critics think, use texts, and manage themselves, there are some important discipline-specific differences. Only a few teachers raised this challenge.

Assessing for knowledge *and* capabilities separately

Interestingly, many of the teachers who described assessing for competencies, values, or dispositions said they were required by their school, or chose for themselves, to use traditional standardised assessments of declarative knowledge.

For example, the secondary teacher leading the STEAM unit described "pressure to rank students involved in the STEAM pilot alongside students doing mainstream classes in the traditional way", especially in science. This year the science students had to do the same assessments as their peers in the mainstream, which the teacher considered unfair, given that they cover different material. She observed that the mainstream students were not required to be assessed on STEAM-related skills such as problem solving.

> I would like every Year 9 and 10 student to do a problem-solving assessment so we can see the impact of STEAM. (Secondary teacher, Auckland)

A junior high school teacher described how teachers at her school "plan as they go". As part of this process, they identify multiple opportunities to assess and then co-construct assessment rubrics. They are building a "library" of useful rubrics and, as part of a TLIF inquiry, they are

working on the idea of learning thresholds that provide indicators of progression. They use the Assessment Tool for Teaching and Learning (asTTle) and Progressive Achievement Tests (PATs) for "effect size calculations" of overall progress. The teacher described a tension between "pure" learning area progressions and more generic ones that are more strongly related to the school's values. At her school, students are awarded badges for demonstrations of the school values—students can identify evidence in or out of school that they are meeting the criteria. Each student has a learning adviser to help them track their bigger learning goals. Reporting is technically "live", but they also email a PDF summary to parents at mid-year. One of the challenges is getting consistency across the school, which this teacher is partially responsible for in her role as deputy principal.

Two secondary teachers working together to integrate science and English described how they initially planned to assess against science and English objectives, but chose instead to focus on the key competencies, using SOLO taxonomy tools for student pre- and post-self-assessment. The first time the process did not work so well because the students hadn't collected enough evidence. The next time they just focused on one key competency—collaboration. For writing they did self- and peer-assessment. For science they used the science capabilities for assessment. This experience led the teachers involved to conclude that:

> You have to be very careful with planning … It is important that you are having an assessment at the end that is about the learning. It's knowing what those [discipline-specific] things are and how they work together. (Secondary teacher, Wellington)

Assessing for knowledge and capabilities in integrated ways

Teachers from some schools were in the process of working out how to assess the combination of knowledge and capabilities that best aligned with students' learning across more than one learning area as they inquired into large open-ended questions. Some teachers had tried to develop rich open-ended assessment tasks that provided students with opportunities to combine and apply the skills and knowledge and capabilities associated with different learning areas.

One of the secondary teachers had designed an integrated unit of work on fossil-fuelled personal transport. He selected four NCEA achievement standards from science and technology. He said that, for him, the "golden standard" would be a single rich task that contained enough evidence individually in relation to each of these standards. This would be in keeping with the integrated approach to teaching and learning the unit of work involved. He had envisaged a task that involved creating a website with pages for each aspect, as well as student photo blogs of their project. However, "it didn't turn out like that" and students defaulted to seeing their work for each achievement standard as self-contained. The critical reflection tasks at the end of the class required students to consider whether or not they saw a future for fossil-fuelled personal transport, and their reasoning behind it. Although student responses were not assessed, the question did involve students drawing together cross-disciplinary knowledge in a way that was consistent with the intent of the teaching and learning.

> We're not assesssing that but we're using it as an overall evaluation of the success of course overall, aside from all the credits. (Secondary teacher, Auckland)

Another secondary teacher had also tried integrated assessment approaches. She observed, nearing the end of the first year of the initiative, that the students had become used to making strong links across their different learning experiences.

9. Student engagement and learning

The main purpose of this study was to learn more about teachers' reasons for integrating curriculum, the different ways they go about it, and the impact this has for school organisation, planning, and teaching. We did not systematically gather information about students' learning outcomes or interview students about their experiences. However, we did record any observations teachers made during the workshops about their students' engagement and learning. In this section we discuss what we found.

Teachers described high levels of student engagement

One of the main reasons why schools had chosen to try curriculum integration was to make learning more authentic and engaging for students. And, overall, most of the workshop teachers considered this to be the case for most of the students they taught.

> I want them to have fun with learning, and I want them to be life-long learners. When I get sent a video of a kid at home holding a ping pong ball above his brother's head with a hair dryer and hear that he has been talking non-stop for three hours about it [his learning] I know that he is going to go on and do more science learning because that's what he wants to do. (Primary teacher, Auckland)

Interestingly, teachers observed that the curriculum integration experiences they offered were especially engaging for students they had traditionally struggled to engage.

> We have a core who are bored by school—disengaged … and it was that core that loved it the most. (Primary teacher, Wellington)

> Some teachers have said students are much more engaged, particularly those who normally wouldn't have been engaged and might have presented with behavioural issues. (Primary teacher, Auckland)

One secondary teacher described how the numer of behavioural and pastoral problems recorded in the school database had "dropped sharply". She said that students are mixing better across the school, since taking the new approach to teaching and learning, which "mixes them up in different combinations for different integrated topics".

However, some workshop teachers described "initial teething problems". For example, at one secondary school, two teachers found that when they first began team teaching there were behaviour management issues due to the change in routine that they had to deal with by re-establishing boundaries.

Others found that there were some students for whom the new approaches did not initially work so well—often those who had excelled in the more tradional classroom.

> The content kids initially hated it … They would have preferred tests … at the end they had come around to how it helped their learning. The lower achievement kids did better, so it was good for inclusivity. (Secondary teacher, Wellington)

> It tends to be the higher achievers that struggle the most—they are used to getting the highest grade. (Secondary teacher, Auckland)

At some schools, children for whom the new approaches were not working were given the opportunity to "opt out" and work in more traditional ways, until they felt ready to participate in the new ways.

> We excluded one student. He picked his own topics. As the year progressed, he integrated back in. (Secondary teacher, Christchurch)

Teachers described positive learning gains for students

Most teachers who continued to make use of more traditional assessments of single learning areas described observing positive shifts in achievement for most of their students, including those who had struggled in more traditional school contexts.

> When I looked at my data over the two years, I found there was a big impact for all my kids, even my special needs kids. (Primary teacher, Auckland)

One secondary school teacher described how admittance to the integrated class was "by application" but students weren't chosen based on academic achievement. The mix of students who took the class included those from the "average" and the "upper" achievement bands. She found that by the end of the year many students in this mixed-ability group were "closer to or out-performing" the upper achievement band.

Another secondary school teacher observed that "achievement has gone through the roof". One lingering problem is that the top achievers in 2018 have mainly been Year 9 students. They have "outstripped" the Year 10 cohort, who had experienced 1 year of traditional curriculum in streamed classes. These Year 10 students had been slower to take up the learning challenges on offer.

Teachers who focused more on building students' capabilities such as thinking, perspective-taking, or relating to others, also described observing positive student outcomes in these areas.

> Teachers saw gains in student retention and independent forward planning. (Primary teacher, Auckland)

Several teachers observed an improved ability for making connections across learning areas, and for applying and transferring ideas across different contexts. One secondary school teacher, for example, observed that, as they neared the end of the first year of their new initiative, the students

had become used to making strong links across their different learning experiences and are now combining aspects of their learning in some of the more open assessment tasks.

> For now, they are perhaps better at making these links than some of the teachers who are still adjusting to this very different way of working. (Secondary teacher, Wellington)

> Working with the same set of verbs for their [school] habits encourages transfer. (Secondary teacher, Auckland)

Teachers attributed student gains to a range of factors

Some teachers attributed increased student engagement and achievement to better teacher relationships. Several teachers described how changes to the timetable and class organisation had allowed for a different relationship dynamic. For example, one secondary school teacher found that with each student taking six courses for the full half year, teachers had been able to build stronger learning relationships. They had also been more successful in "getting to deeper thinking", which has driven gains in achievement.

One of the primary school teachers attributed better relationships with students to the more personalised nature of new approaches which enabled her to be more responsive to her students' interests and needs.

> It's because it's hands on, it's play-based, it's relevant, it's their choice. One group of girls made bags—they chose their topic. They had to design the template, cut it, sew it. They had one parent come in to help and that was it. They did everything else themselves—it came from them. And then they went on to make costumes for the end of year production. (Primary teacher, Auckland)

Other teachers attributed positive shifts in engagement or achievement to students having more time to go into fewer areas in greater depth.

> We spent so much time in each other's subject areas. The students' experience was more time to do things. I found students going, 'Oh we read about this in English', so they were making the connections. (Secondary teacher, Christchurch)

Some teachers attributed positive shifts in student engagement and achievement to the purposeful nature of authentic tasks that students had a vested interest in. For example, one secondary school English teacher observed that her students did better in a writing task with the new approach, even though she provided less explicit instruction and scaffolding, because of having an authentic audience.

> They actually did better because of having an authentic audience … They identified for themselves, the need for appropriate vocabulary. (Secondary teacher, Wellington)

A secondary school science teacher made a similar observation.

> We have hooked in the kids so much better with this … Why are they needing to know the first 20 elements in the periodic table? (Secondary teacher, Wellington)

10. Support for teachers

The last activity of the mediated conversations workshop involved teachers reflecting individually and then recording their ideas about how best to support teachers interested in curriculum integration both in terms of central support (such as professional learning and development and resources) and principal or school leader support. The workshop participants then grouped the ideas into themes. In this section we describe these themes and provide some examples of the participants' suggestions.

Rationale for curriculum integration

Some workshop participants considered that teachers needed support building a strong theoretical foundation and rationale for curriculum integration. They considered that this involved "challenging thinking behind curriculum design". They saw access to the existing research literature on curriculum integration to be important as part of this reflective process.

> Time to research—be sure of the 'why' ['Why carry out curriculum integration?'].

> Access to information—robust research and data.

Workshop participants considered that a research-based rationale was needed, first for reflection on the potential benefits and challenges of curriculum integration for student learning and engagement, and second as a means for teachers developing their *own* shared context-specific vision—a need discussed later in this section.

Interpretation of *The New Zealand Curriculum*

Workshop participants considered that, along with support developing a research-based rationale for curriculum integration, teachers need "a real understanding of *The New Zealand Curriculum*" (Ministry of Education, 2007) including understanding the interconnections *between* learning areas along with the progressions *within* learning areas.

> All teachers need to see the whole picture: Year 0 to Year 13 and Year 13 to Year 0.

> An idea from intermediate to primary, college to intermediate, and university/tech to college, what skills, attitudes, and knowledge students need and are missing.

> Collaboration across primary to tertiary.

Workshop participants identified the need to consider the place of knowledge, and the place of values and competencies in an integrated curriculum.

> Discussions and debate about disciplinary knowledge and curriculum integration.

50

> Better unpacking of values/capabilities in *The New Zealand Curriculum* to support people with connecting learning across learning areas.

This included a better knowledge of te ao Māori.

> Te ao Māori mind shift in terms of reo, tikanga, pūrākau, mātauranga.

The identification of these needs is consistent with the challenge many of the workshop participants identified of how to "balance student agency and knowledge".

Shared school and community vision

Workshop participants saw a research-based rationale and a deep understanding of *The New Zealand Curriculum* (Ministry of Education, 2007) as the foundation for building a shared school vision. Teachers saw a school vision for curriculum integration as important to keep themselves focused and on track. They saw the need for time and support to develop the vision.

> Ensuring there is a shared school vision as the basis for curriculum integration.

> Time to develop a vision—guiding principles.

> Time to establish goals and purpose and to plan.

Some also commented on the need for collaborating with whānau, and members of the local community in the creation of this vision.

> Whānau—their hopes and dreams.

Workshop participants also saw the need for greater connection with the wider community to support teaching and learning *through* curriculum integration, particularly given that curriculum integration in many schools involves drawing on community expertise.

> Means to connect with industry, community, government to make learning authentic.

> People to be [in] our space: art historians, artists in residence, tohunga …

> Consultation with whānau (tapping into their strengths).

> PD for staff on industry futures—not education but medical, transport, financial etc., so they understand or have eyes open to potential futures.

> Links with industry.

Sitting behind many of these suggestions is the association between curriculum integration and the "real world" where "authentic" learning can happen.

Others saw the need for informing whānau about more future-focused approaches to curriculum and getting their support for curriculum change.

> Educating communities to demand change from schools, especially high decile schools.

Models for planning, teaching, and assessment processes

Workshop participants saw the need for models, exemplars, and resources for different "types" of curriculum integration or different "ways" of carrying out curriculum integration to help teachers determine an approach that would best suit *their* context.

> Access to a variety of models of integration.

> Shared models of integration from 'connection' to seamless integration.

They also wanted examples of how curriculum integration might work at different levels of the school, and especially in relation to NCEA, and in the senior secondary school.

> Clearly told stories or examples of successful integration at different levels.

> Examples of integrated systems that work with *why* they worked—especially for NCEA.

> Support for carrying curriculum integration in to the NCEA years.

Workshop participants saw support with the *process* of planning for, and teaching through, curriculum integration as being as, or more, important as the *content* or *products* of that planning.

> A focus on the *process* of planning, not just the content (i.e., how did they come up with the plan rather than the 'what').

> Videos of people starting, and the *process*—not so much on the end product.

> Release time to see in action, and then discuss as a team.

This desire for support to understand the *process* of planning for, and teaching through, curriculum integration may help explain why workshop participants saw the need for examples and models being best provided by other *teachers* who had tried it—as opposed to being provided by PLD organisations.

> Funding 'expert' *practitioners* to get out and help other schools—not [PLD] consultants.

> Some video interviews with teachers who have integrated, with explanations as to why they work.

> See what other schools are doing—having those conversations.

Some participants highlighted the need for examples of how learning was tracked and outcomes were measured, again, especially in the context of NCEA.

> Shared exemplars including … progress of learning and outcomes.

> Evidence collection towards multiple standards/fit for purpose systems for NCEA awarding of standards/tracking.

> Some examples of how two or more standards are assessed in the same piece of evidence.

> A 'go-to' place outlining possible systems for reporting and assessment.

Others wanted "Buy in from NCEA"; that is, for NCEA to be structured in ways that better support curriculum integration. Some of the workshop participants saw the review of NCEA, just underway at the time of the research, as having the potential to address some of these needs.

> Waiting for the outcomes of the NCEA review—have high hopes for significant changes.

> Hurry up with the review of standards too!

Support with making change

There were a few suggestions, mainly from the workshop participants who were senior leaders, about the need for support in change management.

> Change management guidance.

> Information/PD surrounding change as a teacher.

> Identification of key drivers that require/promote change to curriculum.

> Professional supervision, coaching support.

Some workshop participants identified the need for support with collaboration in terms of time, PLD, and resources.

> Time for teachers to collaborate within school and across schools.

> PD around collaboration.

> Time to plan collaboratively across different learning areas.

> Time to establish teams and relationships.

Workshop participants who were classroom teachers identified the need for support from school leaders to "try new things", "play", and carry out safe-to-fail experiments in the curriculum integration space, even on a small scale. They described the need for: "opportunity and freedom to try"; "permission and support to make mistakes"; "PLD time just to imagine the possibilities"; "chances to play, time to explore"; and "staffing risk-taking—time for exploring options and visioning".

A physical environment that supports curriculum integration

Modern learning environments and curriculum integration are often seen as going together. Workshop participants came from new schools as well as from schools with more traditional buildings. Some workshop participants considered that teachers engaging in curriculum integration needed physical spaces to support this type of teaching and learning. They mentioned the need for: "physical restructuring of learning spaces"; "modern learning environments"; and "funding for structural changes of traditional buildings (e.g., interconnecting spaces, maker spaces)".

Inquiry into the impact of curriculum integration

Finally, workshop participants saw the need for support with inquiry into the *impact* of curriculum integration in terms of student learning and engagement.

> Support with evaluation from researchers.

Several identified the importance of student voice as part of such an inquiry.

> Student voice—before and after curriculum integration.

> Showcasing examples of learning and voice.

Overall, the workshop teachers had an inquiry mindset shown in their desire for support with developing a rationale and vision for curriculum integration, as well as support measuring the impact of the changes they had made.

11. Discussion

Curriculum integration is supported by *The New Zealand Curriculum* (Ministry of Education, 2007). It is widely adopted in New Zealand primary schools and is becoming increasingly common in secondary schools (Bonne & MacDonald, 2019). This is especially so in the context of new school builds and modern learning environments.

Teachers identified a range of benefits for students

Most of the teachers in our workshops had introduced curriculum integration as part of a wider suite of student-centred pedagogical approaches such as: student-led inquiry; personalised learning; play-based learning; project-based learning; flexible use of time and space; multi-level/age classes or groups; and modern learning environments—a finding consistent with other New Zealand-based research (Boyd & Hipkins, 2012). The main reasons they gave for integration were to provide students with opportunities to: explore issues that are relevant and important to them; experience engagement and achievement at school; build capabilities needed now and in the future; see connections and go deeper in their learning; and "cover" the curriculum (in time-effective, efficient, and meaningful ways). These goals appear to be consistent with the intent described in *The New Zealand Curriculum* (Ministry of Education, 2007). And, indeed, teachers in our study described observing many of these benefits.

Challenges related to dual goals of agency and knowledge

The main challenge teachers faced related to disciplinary knowledge. Many teachers were unsure of how to ensure students had opportunities to learn the knowledges, discourses, and practices of the different learning areas without compromising student agency and the democratic principles of curriculum integration. They referred to this challenge as "finding the balance between student agency and knowledge". They worried that ensuring "coverage" of the breadth and depth of *The New Zealand Curriculum* (Ministry of Education, 2007), through careful selection and planning of inquiry topics, resulted in students' agency being limited and the democratic component that makes curriculum integration what it is, being lost. But these teachers also worried that if these opportunities were *not* planned, taught, and assessed for, students may come away with little conceptual growth, little understanding of how knowledge is built in the disciplines, and little experience of knowledge building. The worst-case scenario resulting from the knowledge/agency dilemma is that in trying to meet both goals—agency and knowledge—neither is achieved.

Instead, students experience curriculum integration as a highly teacher-directed experience, with a token amount of choice about topics of inquiry or forms of disseminating findings which consist largely of information retrieval and presentation.

The aim of teachers was that students have agency *and* opportunities to build knowledge in the service of goals that are meaningful to them, their whānau, and their communities. And both goals are important. We want all students to see learning as relevant, engaging, and connected, and we want all students to develop conceptually and have opportunities to build knowledge, not just acquire and re-present information. This capacity opens doors to life chances: it enables students to design their own social futures and is necessary to solve the complex issues of our time. However, meeting the dual goal of student agency and knowledge building is a challenging undertaking for teachers even in the context of *single*-subject teaching. And a related challenge is how to assess students' learning, given the limited number of tools available with the capacity to measure the complexity of student learning that teachers were aiming for.

Most of the workshop teachers had been trialling various forms of curriculum integration for quite some time and had made a series of rolling adjustments to their planning, teaching, and assessment to meet their goals. At the time of the workshops, most described offering coming models in which students continued to experience more traditional, single-subject teaching much of the time with the addition of opportunities to combine, apply, and transfer what they had learnt in these single subjects to a big question or issue.

The teachers considered that such approaches helped to engage students, especially those they had previously found difficult to engage. Curriculum integration allowed for more student-directed and personalised learning through which students could explore issues relevant to them, their whānau, and their communities. Many considered that students' learning was "deeper" when such approaches were used, and that achievement was like, or better than, previously. However, nearly all teachers acknowledged that it was not possible with the existing assessment tools to provide evidence of this.

Teachers identified the need for support

The teachers in our study wanted more support in planning, teaching, and assessing in the context of curriculum integration. *The New Zealand Curriculum* (Ministry of Education, 2007) states that "for each [learning] area, students need 'specific help from their teachers' as they learn: 'the specialist vocabulary associated with that area' and how to: 'read and understand its texts'; 'communicate knowledge and ideas in appropriate ways'; and 'listen and read critically, assessing the value of what they hear and read'" (Ministry of Education, 2007, p. 16). However, examples of what the "help" described above might look like as part of an integrated unit of work (or, even in single-learning areas), are sparse. *The New Zealand Curriculum* does not exemplify links between the front and back halves of the document, and there is little additional support, and few models, of *how* teachers might do this, either in individual learning areas or when learning areas are integrated. The teachers in our study emphasised the need for such examples.

Teachers also wanted support in the form of tools and examples to assess students' learning across more than one learning area as they inquired into large open-ended questions, including performance-based assessment and reporting strategies. Many of the teachers in our study had used the SOLO taxonomy—both in sophisticated, and less sophisticated ways—to facilitate student self- and peer-assessment. Teachers wanted assessment tools that focused on students' understanding of the nature of the disciplines, and their knowledge-building capabilities, as well as their declarative knowledge. As noted in Hipkins and Cameron (2018), there is little research and few tools that teachers can use to help students reflect on their learning in deep and meaningful ways.

PLD with a focus on planning, teaching, and assessing for building disciplinary knowledges, discourses, and practices is also needed in the context of curriculum integration (and in the context of single-subject teaching).

The support teachers asked for is consistent with the findings of a recent article focused on how student-led pedagogies such as curriculum integration may be strengthened in countries like New Zealand and Israel. Zohar and Hipkins (2018) highlight the need at the system level for expectations and assessment criteria when knowledge building is the focus; examples of instruction and assessment; and professional learning and development that will support educators' understanding of disciplinary practices.

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