Educational reform and change relating to curriculum, pedagogy, standards, evaluation and professional learning have an important role to play in educational improvement initiatives. In this paper, I explore insights from policy, research and practice initiatives across key aspects of the New Zealand education landscape, relate those to improvement efforts internationally, and highlight implications and possibilities for teacher education. In particular, the focus is on curriculum reform, inquiry oriented practice, and collaborative inquiry-key: Elements of those policy turns are outlined, and consideration given to the implications for initial teacher education.

Keywords: Industrial revolution 4.0; Teacher education; New Zealand; Educational improvement.

Curriculum Reform: Responsive Pedagogy

While there are distinct differences between the curricula of various countries that have a national curriculum, many recently revised curricula not only signal desired outcomes for students, but also promote certain pedagogical approaches. This is apparent, for example, in the introduction to Scotland’s Curriculum for Excellence which highlights that “[the curriculum is] concerned both with what is to be learned and how it is taught”. It is also apparent in the section of the New Zealand Curriculum (NZC) that addresses “effective pedagogy” (The New Zealand Ministry of Education 2007).

The pedagogical approaches promoted in these and other recently revised curricula are characterized by five dimensions of responsiveness that address the extent to which these approaches are being implemented. The first is responsiveness to the kinds of learning relevant for 21st century learners; this requires that educators move their attention beyond content knowledge and discrete skills outcomes to encompass students’ competencies for lifelong learning. The second is responsiveness to demands for increasing emphasis on values in teaching and learning, which requires the integration of values across the curriculum. The third is responsiveness to increasing ecognition that students have both the capability and the right to be deeply involved in decisions relating to their education; this requires pedagogical practices that enhance student agency in decisions about teaching, learning and assessment.

The fourth is responsiveness to a growing body of evidence of relevance to practitioners about effective teaching approaches; this requires the promotion of inquiry into practice in ways that demonstrate engagement with practitioner and research evidence. The fifth dimension of responsiveness calls for strengthened partnerships with parents in efforts to support better student learning; this requires educators to more seriously engage in partnerships with parents in relation to teaching and learning. This turn to competencies is currently central to the OECD Education 2030 curriculum framework.

Responsive Curriculum Dimensions

The following section outlines key elements of five dimensions of responsiveness that were the basis for the responsive curriculum scale arising from an evaluation of New Zealand’s most recent national curriculum (Sinnema & Ludlow, 2014): key competencies, values, inquiry, student agency and partnerships.

Beyond content knowledge and skills to key competencies in curriculum

Increasingly curriculum policies have moved towards emphasizing 21st century competencies for lifelong learning. So what are key competencies? Key competencies integrate knowledge, attitudes and values in ways that lead to action. They cannot be taught discretely, are context dependent, and involve practice and application in authentic real-
world contexts (Rychen and Salganik 2003). Unlike discrete skills, key competencies are described as having transformative potential (Reid 2006)—that is the potential to transform students’ and teachers’ experience of teaching and learning to be quite different to traditional approaches. Key competencies also have a dispositional character, which requires attention not just to students’ ability to use them, but their readiness and willingness to do so appropriately in a range of contexts (Carr and Claxton 2002, Hipkins 2007, Cowie and Hipkins 2009). Key competencies involve a range of psychosocial resources (including skills and attitudes) that are applied in particular contexts. They promote trans-disciplinary thinking in ways that enable the development of new expertise (Australian Ministerial Council on Education and Youth 2008).

Globalisation and modernisation are creating an increasingly diverse and interconnected world. To make sense of and function well in this world, individuals need for example to master changing technologies and to make sense of large amounts of available information. They also face collective challenges as societies—such as balancing economic growth with environmental sustainability, and prosperity with social equity. In these contexts, the competencies that individuals need to meet their goals have become more complex, requiring more than the mastery of certain narrowly defined skills.

The call to move beyond narrowly defined skills in revisions to national curriculum policies is evident in curriculum revisions in a number of countries. In the current development of a national curriculum in Australia, for example, general capabilities are outlined:

Increasingly, in a world where knowledge itself is constantly growing and evolving, students need to develop a set of skills, behaviours and dispositions, or general capabilities that apply across subject-based content and equip them to be lifelong learners able to operate with confidence in a complex, information-rich, globalised world. (Australian Curriculum Assessment and Reporting Authority 2010, p. 18).

More recently, the Education 2020 framework has extended the competencies to encompass ‘creating new value’, ‘reconciling tensions and dilemmas’ and ‘taking responsibility’ to address environmental, economic and social challenges in a rapidly changing world (OECD, 2018).

The key purpose of Scotland’s Curriculum for Excellence demonstrated the early 2000s move to competencies in promoting the development of four capacities (to enable each child or young person to be a successful learner, a confident individual, a responsible citizen and an effective contributor) and interdisciplinary studies (Scottish Executive 2004). The interdisciplinary aspect focuses on students experiencing learning in stimulating contexts, and that learning being relevant, challenging and enjoyable. It also prioritizes students’ development of deep understandings through revisiting learning and considering multiple perspectives. Interdisciplinary studies are also likely to involve student learning in contexts beyond the school site, in ways that enrich their learning and emphasize competencies alongside content.

The place of values in curriculum. Increasingly, national curricula reflect demands for emphasis on values in teaching and learning, not as a stand-alone or peripheral consideration, but as a vital element of curriculum design. As Lovat and Toomey put it “no longer is Values Education on the periphery of a curriculum that enshrines the central roles to be played by the teacher and the school in our society. It is at the very heart of these roles” (2009, p. 11). The expression of values in recent curricular reforms also make clear that while values education should transform beliefs and behaviour this does not require the imposition on students of different sets of beliefs and values than those they already held. It does, though, mean “challenging students to see that whatever beliefs and values they brought with them are but one set, one life-world, and to consider the life-worlds of others” (Lovat and Toomey 2009).

Keown, Parker, and Tiakiwai (2005) signal the risk of approaches that lead to simplistic practice in the teaching and learning of values, based merely on lists of agreed values, but in which “the wide range of meanings and concepts across ideologies are not fully explored” (p. 179). Recent curriculum reform in New Zealand has sought to address that risk by outlining values to be encouraged, modeled and explored in teaching and learning. While values have always had a place in the New Zealand curriculum, this aspect is much more prominent in the most recent curriculum (2007) than in previous curriculum frameworks and goes well beyond merely determining sets of desirable values to be upheld. In addition to setting out a list of widely supported values that students should be encouraged to hold (including for example excellence, equity, integrity, respect), the new curriculum signals that students should also learn about values, and how to express, explore and critically analyze values (Keown, Parker et al. 2005). References to values in this sense are also evident in the curriculum of Northern Ireland (Council for the Curriculum Examinations and Assessment 2007) Such prominence of values is evident internationally.

The responsiveness of curriculum here is not in terms of the inclusion of values in curriculum, but in the positioning and emphasis of values as a
pursuit that is central and pivotal to the endeavors of teachers, schools and systems “rather than being on their margins” (Lovat & Toomey, 2009, p. 9).

Emphasizing inquiry in curriculum. The close examination by teachers of the impact of their work on students is “the pedagogical imperative” (Shulman 2002) and reflects the professional nature of teaching (Stoll, Fink et al. 2003). As Cochrane-Smith argued, it is important that teachers treat “their own work as sites for systematic and intentional inquiry into their own and other’s research as generative of new possibilities” (Cochran-Smith 2005, p. 8). This requires them to take an inquiry stance to their practice which involves much more than being reflective or questioning. It involves a “continual process of questioning and using the data of practice to investigate those questions critically and collaboratively” (Cochran-Smith and Lytle 2009, p. 121). A notable characteristic of curriculum reform efforts is attention, to varying extents, to this kind of inquiry. In some curriculum policies, the suggestion of inquiry is hinted at through reference, for example, to the curriculum promoting reflection on what has been learned and how that learning occurred or through mention of assessment being organized ‘to support and influence teaching and. In the New Zealand system, however, the notion of inquiry as a curriculum concern is much more prominent.

The NZC sets out a model of effective pedagogy - teaching as inquiry - that requires educators to engage in three kinds of inquiry as they seek to achieve curriculum goals: focusing inquiry, teaching inquiry and learning inquiry (Aitken and Sinnema 2008, p. 52). student outcomes and inquiry into the relationship between the teaching and those outcomes. This dimension will be elaborated in the next section.

Promoting student agency in curriculum. Agency is the ability to exert control over, and give direction to one’s life (Emirbayer and Mische 1998). Student agency, or the ability for learners to exert control over their experience of teaching, learning and assessment, is described as important in several curricula. It involves students making connections between their past learning experience, and aspirations for the future, which enable them to take action the present. Tomanovic describes children as being afforded autonomy, control, and influence in this action in ways that acknowledge their competence (Tomanovic 2003). This contrasts a kind of participation whereby students act mainly in response to teachers’ decisions and demands — a distinction between what Shier (2010) frames as participation as social control versus participation as empowerment.

Shier outlines five levels of participation that are useful in analyzing the focus on student agency and participation in curriculum: (1) Children are listened to; (2) Children are supported in expressing their views; (3) Children’s views are taken into account; (4) Children are involved in decision-making processes; (5) Children share power and responsibility for decision-making (Shier 2001, p. 112). He also makes clear the link between this kind of participation in schooling and Article 12 of the UN Convention and suggests that there are openings, opportunities, or obligations that can occur for each of the participation levels.

In the New Zealand Curriculum, the call for student agency in teaching and learning is most apparent in the key competencies, but is also suggested in many other elements of the document. Since student agency can only be achieved in action, of particular importance to this research was the expectation that students become increasingly active participants, alongside their teachers, in decisions about curriculum, teaching, learning and assessment.

Strengthening partnerships with parents in curriculum. The importance of partnerships between those responsible for educating students in school settings and their parents is gaining increasing attention. Such partnerships are crucial to system improvement as signaled in The McKinsey report, which describes engagement with parents as a high impact means of improving outcomes for students (Mourshed, Chijioke et al. 2010). School-family partnerships are, potentially, particularly educationally powerful (Epstein and Sheldon 2006, Robinson, Hohepa et al. 2008). While different types of school-home connections vary widely in their effectiveness in promoting social and academic outcomes (some can even be counter-productive), joint interventions involving parents and teachers have been found by Robinson et al. (2008)- in a meta-analysis of 37 studies, syntheses, and meta-analyses reporting on outcomes for over 180,000 students - to have a very high effect size (1.81).

It is not surprising then that national curricula are increasingly urging high quality partnerships between schools, teachers and parents. Scotland’s Curriculum for Excellence indicates the importance of working in partnership to support students, and of involving parents and caregivers in curriculum planning. This reflects Scottish legislation (2006) that aims to help parents to be involved with their child’s education and learning, welcomed as active participants in school life, and encouraged to express their views on school education.

Similarly, the 2007 New Zealand Curriculum has ‘community engagement’ as one of its eight principles, and places far greater emphasis on this notion than the previous curriculum. It requires schools and teachers to encourage greater
involvement of parents and local communities in their children’s learning. Most importantly, it signals the involvement of parents not just as recipients of communications from schools, but as meaningful partners in teaching and learning efforts for their children.

**Autonomy in national curricula**

Characteristic of educational policy in many jurisdictions in recent times is an emphasis on curricular autonomy, or at least moves toward increased curricular autonomy compared to previous curricula. Whilst the degree of autonomy and the elements of the curriculum it relates to vary from place to place, and systems offering low levels of curricular autonomy remain fairly common across OECD countries, “the most common configuration is the one that gives schools the freedom to make curricular decisions” (OECD 2011, p. 45). That increase in school-level authority to make decisions about curriculum content have been noted in relation to the curricula of Scotland and New Zealand (Sinnema and Aitken 2013) and of Finland, Japan, Brazil and parts of China and Canada (OECD 2011). Curriculum, and I refer here specifically to the planned curriculum, is increasingly deemed to be not only the concern of policy makers, but also the concern of practitioners based in schools, including school leaders and teachers. Schools are asked to address the challenges inherent in designing and implementing a local curriculum in a manner that also ensures they give effect to a national curriculum. Those challenges are strongly impacted by the degree and nature of autonomy in the national curriculum.

Whilst there is evidence of increasing curricular autonomy in many jurisdictions, the pattern internationally is mixed. Describing the current pattern across nations with regard to curricula (and their autonomy) is complex, given those curricula are in a constant state of change - at any given time countries are often either embarking on, in the midst of, or responding to curriculum review processes of some sort. Central issues that are typically addressed in those reviews are about alternatives in what a revised curriculum should emphasize: autonomy versus prescription, reduced versus expanded curriculum content; expanded curriculum content; local versus national priorities; and knowledge versus competencies. In some countries, New Zealand and Scotland for example, curriculum change has led to increased local decision making, greater autonomy for schools, reduced content prescribed at a national level and emphasis on competencies and capabilities. The tide of curricula autonomy in those countries might be described as high (with high freedom for teachers). In England and Australia, by contrast, the tide has been going out - with tightening of national control, prescription and regulation over curriculum, with expanding curriculum content and a more explicit emphasis on core knowledge.

The analogy of tides and curricular autonomy works in at least two ways. First, like tides, levels of curricular autonomy are different in different places at the same time. While the issues that national curriculum reviews often respond to are sometimes quite similar in different contexts (the need for improved teaching quality, higher student achievement, schooling improvement and greater education system equity, for example) some systems take the autonomy route, while others the prescription route. That contrast is evident currently in the curricula of New Zealand and of England. Second, like tides, levels of curricula autonomy are constantly changing. A national curriculum that is highly prescriptive at one point in time is often reported to be much less so at a subsequent point in time, and vice versa. These changes in the nature of curricula are influenced by perceptions of the problems that policy makers seek to address in the design, or re-design, of a national curriculum. During curriculum developments in New Zealand in the mid- 2000s, for example, overcrowding in the curriculum of the preceding decade was considered a problem (Le Métais 2002). That problem was emphasized in calls to revise the curriculum and strengthen its role as a lever for improving student achievement. The revised curriculum of 2007 sought to address the over-crowding problem by significantly reducing prescription. In addition a great deal of emphasis was given, in the national curriculum itself, to the importance of schools designing a locally relevant curriculum to give effect to broad curriculum requirements.

**Inquiry oriented practice**

The New Zealand Curriculum sets out a model of effective pedagogy—teaching as inquiryn - that requires educators to engage in three kinds of inquiry as they seek to achieve curriculum goals: focusing inquiry, teaching inquiry and learning inquiry (Aitken and Sinnema 2008, p. 52). This inquiry approach is central to many initiatives including those focused on teacher professional learning and development. The focusing inquiry requires careful attention to prioritizing what matters most for the teachers’ students given the curriculum requirements, community expectations, and most importantly, the learning needs, interests and experiences of the learner. The teaching inquiry requires attention to both outcomes-linked research evidence and practitioner experience to inform decisions about what teaching strategies will be tried. It encourages teachers to view research evidence as the basis for explaining findings about the impact of their own practice on their students’ learning, and as sources of better- informed conjectures about what
might enhance learning for students in their classrooms. The learning inquiry requires consideration of the impact of teaching actions on student outcomes and inquiry into the relationship between the teaching and those outcomes.

The origins of teaching as inquiry

Each of us has our vision of teaching at its best. This is powerfully shaped by our experiences as teachers and as learners, where we remember teachers who taught in ways that worked for US. This lends US to think about teaching in what is commonly referred to as a style-based way, with effectiveness measured by how closely a teacher’s actions match our ideal. But not all learners are like us. A view of effective teaching needs to accommodate something larger than a personal, idiosyncratic interpretation of effectiveness.

A more refined view of the style-based approach is to derive our vision of ideal teaching from the research literature. There is a long tradition of educational research that seeks to identify the qualities and practices of effective teachers. So we get lists of qualities that effective teachers are expected to match, such as warmth, enthusiasm and being business-like, and practices they should undertake, such as direct instruction, clear ‘nations and efficient routines. Most recently, this approach has been refined through the use of meta-analysis to rank practices according to their effect size (see e.g., Hattie, 2009; Marzano, Pickering & Pollock, 2001). As Stanford Professor Lee Shulman pointed out many years ago in relation to the findings of process-product research Shulman,1987), what such work does is establish the principles we need to employ as about our teaching. What it does not do is prescribe specific methods or rules that determine effectiveness or excellence. The contexts within which teachers teach (age of students, cultural context, prior knowledge and experiences of students, subject, time of day and the like) are so diverse that no prescription of particular practices will suffice to capture an inclusive aspiration for the profession. And in any case, a style-based way of thinking leads US to look in the wrong place - at the actions and behaviours of the teacher, not at the responses and outcomes for students. As Berliner points out, following a style-focused view of effective teaching, a student teacher can be judged to be good if they model the desired practices irrespective of whether the students learn (Berliner, 1987).

An alternative view is, therefore, to define effective teaching by student outcomes (see Table below). This approach has popular appeal and a simple logic: effective teachers cause students to learn. Thus, high student achievement can be attributed to effective teaching and low achievement can be attributed to ineffective teaching. The league tables of school pass rates in national examinations reflect such logic - the implication being that the best have the highest pass rates and by extension have the best teachers.

### TABLE. The ideas and claims of style- and outcomes-based views of effective teaching

<table>
<thead>
<tr>
<th>Key ideas</th>
<th>Related claims (examples)</th>
<th>Key ideas</th>
<th>Related claims (examples)</th>
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<tbody>
<tr>
<td>Style in terms of personal attributes indicates teaching effectiveness.</td>
<td>Effective teachers display warmth. Effective teachers are enthusiastic.</td>
<td>Outcomes in terms of what students achieve indicate teaching effectiveness.</td>
<td>Effective teaching is evident when a teacher’s students achieve well. Effective teaching can be seen in the progress demonstrated by students.</td>
</tr>
<tr>
<td>Style in terms of particular teaching techniques indicates teaching effectiveness.</td>
<td>Effective teachers provide an overview at the start of teaching something new. Effective teachers use a variety of interesting resources in each lesson.</td>
<td>Comparison of students’ achievements indicates comparative teaching effectiveness.</td>
<td>The comparative effectiveness of teachers is best determined by comparing the achievements of the students they teach. Judgements about more and less effective teaching can be made by comparing: how well various teachers’ students achieve.</td>
</tr>
<tr>
<td>Style in terms of general teaching approaches indicates teaching effectiveness.</td>
<td>Effective teachers minimise the amount of time they are teaching the whole class from the front (direct instruction). Effective teachers facilitate the joint construction of knowledge through teacher-student and student-student conversations.</td>
<td>Comparisons of the value teachers add to students’ achievement indicates comparative teaching effectiveness.</td>
<td>The comparative effectiveness of teachers is best determined by comparing the added value they contribute to the achievements of the students they teach. Judgements about more and less effective teaching can be made by comparing how much difference various teachers make to their students’ achievement.</td>
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While there is no disputing the need to base the assessment of teaching effectiveness on student learning.
and achievement, this simple logic has several flaws. The first is that differences in student achievement may not be attributable to a teacher’s teaching. The significance of prior knowledge has been consistently associated with student achievement and cannot be overlooked. On the basis of their intensive monitoring of students in classrooms, Nuthall and Alton-Lee are definite about the influence of prior knowledge on achievement. In particular, they note that when there is a significant misconception or misunderstanding in a learner’s prior knowledge, the learning that would otherwise be expected, is subverted (Nuthall & Alton-Lee, 1993). This makes it unfair to compare the summative achievements of students and to attribute the differential to superior or inferior teaching.

A more refined view of the outcomes approach is the value-added approach that links teaching effectiveness not to achievement but to learning - in other words, to progress between time point one and time point two. The difficulty here is that the measurement of such learning, if it is to be genuinely attributed to a teacher’s teaching, is either very simplistic and restricted to narrow outcomes that are easy to measure, or it is extremely complex. The complexity arises because learning is not just influenced by teaching but by factors such as family background, ethnicity and social class. A genuine measure of a teacher’s contribution to learning would need to take account of these significant influences. Furthermore, even when such a measure is available there is no guarantee that the learning of a student is attributable to the teacher. The student may well have received extra tutoring or support from external sources.

The value-added approach also takes no account of the student’s contribution to learning. A teacher’s ability to progress a student between time point one and two is influenced by factors internal to the student such as personal organisation, interest, motivation, personal attributions of success or failure, and self-efficacy for particular subjects and tasks. While it is certainly true that a teacher can mitigate these influences, they cannot be simply dismissed as irrelevant to student progress and by extension to the assessment of teaching effectiveness.

The style-based approach has given welcome and renewed prominence to scientifically grounded research findings and their implications for teachers’ practice. Whereas, the outcomes-based approach has given undeniably important prominence to student achievement and learning. However, neither approach is sufficient on its own to define teaching effectiveness. What is needed is a view of effectiveness that is based on the systematic and consistent interrogation of the relationship between what the teacher is doing and what is happening for the students - that is: Teaching as Inquiry.

**The nature of teaching as inquiry**

The model of Teaching as Inquiry as described in The New Zealand curriculum (Ministry of Education, 2007) emerged during the development of a best evidence synthesis - a synthesis aimed at making the findings of multiple research studies accessible to teachers. The studies included were those that showed how teaching social sciences can impact positively on outcomes for diverse learners. It became clear, however, that merely providing the research findings for teachers, and doing so in a way that suggested certainty about the impact those strategies would have when applied, was not ideal.

While looking to research findings has clear benefits for teachers, and it is a professional obligation to do so, there are also risks involved that need attention. There are risks associated with looking to general research findings since they may not appear to offer anything new - teachers may believe they are already employing the suggested approach when in fact there are subtle differences (Sinnema & Aitken, 2011). There are also risks when looking to particular research findings since those particular approaches are certain not to work in exactly the same way in different contexts (Sinnema & Aitken, 2011). As can be seen in the various teaching strategies described in the social sciences best evidence synthesis (Aitken & Sinnema, 2008; Sinnema & Aitken, 2012), some quite similar strategies worked in one context, or for one learner/group of learners, or in relation to one outcome, but did not work in another context, for another learner/group of learners or in relation to a different outcome.

To address those risks we proposed a model of Teaching as Inquiry as vital to effective pedagogy. The model, as it stands in The New Zealand curriculum (Ministry of Education, 2007), presents three key components that are detailed below - focusing inquiry, teaching inquiry and learning inquiry. Those inquiries, as argued in an elaboration of the teaching as inquiry model (Sinnema, Meyer & Aitken, 2017) are strengthened by drawing on resources, including a body of knowledge (about learners, learning, society and culture, content, pedagogy, content pedagogy, curriculum and assessment); competencies (cultural, intellectual, critical, relational and technical); dispositions (such as open-mindedness, fallibility, discernment and agency); and through commitment to ethical principles (commitment to learners, families, the profession and society) and commitment to social justice (through challenging racism, inequity, deficit thinking, disparity and injustice).

The following sections discuss the key components of the Teaching as Inquiry model -
focusing inquiry, teaching inquiry and learning inquiry. This model does not simply describe actions; it is underpinned by a set of attitudes towards teaching and learning:

Foremost among these are open-mindedness, fallibility, and persistence, open-mindedness refers to a willingness to consider teaching approaches that may be unfamiliar or that may challenge one’s beliefs about the best ways to teach. It refers also being open to what the evidence shows about the effects of teaching on student Reaming. Fallibility refers to the lively realisation that however strong the evidence may ‘e’ educational research findings are always conjectural because they are context-bound. Fallibility involves accepting the possibility that what was, or what has been, successful with one group of learners may not be successful for another and that, for this reason, well-designed intentions might fail to generate the desired response. The need for persistence directly follows from fallibility, as teachers must inquire again into the focus of future learning and into the possibilities for future, more effective action (Aitken & Sinnema, 2008, p. 53).

These kinds of attitudes have implications for each of the inquiries detailed in the following sections.

**Focusing inquiry**

In the focusing inquiry teachers consider the priorities for their students’ learning. There are countless things that are important for students to learn. It is a teacher’s responsibility to think about which of those things are most important. Being clear about those priorities, through knowing the relative importance of many possible important outcomes, enables a clear sense of direction. It also makes decisions about how to allocate time much easier, which is useful since there is limited time available in each lesson, each week, each term and each school year. How the available time is spent should reflect the learning priorities for students.

For teachers to make good decisions about priorities for their students they need to know and understand where their students are currently at, and they need to know and understand what the national and school-level curricula set out as desirable outcomes. They need, therefore, to be able to carry out assessment and use the results formatively to respond to those in ways that move students toward meeting the goals of local and national curricula.

**Teaching inquiry**

In the teaching inquiry teachers consider how they could and should go about teaching in ways that are most likely to help learners achieve the priority outcomes established in the focusing inquiry. There are two key informants of teachers’ decisions about what approaches and strategies are most likely to work - the first is the experience of practitioners including their own and others’ (Furman, 2018) and the second is research evidence (Sinnema & Aitken, 2014).

Let us say, for example, a focusing inquiry establishes that students have weaknesses in understanding fractions and also establishes that learning fractions is a high priority for a particular group of students. In the teaching inquiry, the teacher should consider (alongside their own and colleagues’ previous experience) what research evidence suggests might be useful in addressing that learning priority. They might turn to a synthesis of mathematics education research evidence (Anthony & Walshaw, 2007) or to a particular study cited in that-synthesis. A study carried out by Kazemi and Stipek (2001), for example, reveals the importance of teachers creating a high press for conceptual thinking through their practice. The researchers used videotapes of lessons about the addition of fractions in four low decile classrooms and analysed the conversations to establish whether they demanded high or low press for conceptual thinking. In two of the four classrooms there was a consistently high press for conceptual thinking. The researchers noticed that in the high press classes: (a) explanations were not just procedural descriptions, but included a mathematical argument; (b) mathematical thinking was shown to involve understanding relations among multiple strategies; (c) errors were used as opportunities to reconceptualise a problem, explore contradictions in solutions and and pursue alternative strategies; and (d) during collaborative work there was an expectation that each student would be accountable for thinking through the mathematics involved in a problem and consensus would be reached through mathematical argumentation.

In the other two classes there was typically a lower press for conceptual thinking. Unlike in the high press class: (a) instructions were given in a general way (e. g., “work with a partner”, “work together on this”); (b) often the work was not shared amongst all students in a group; and (c) students who weren’t sure what to do often withdrew and allowed someone else to take over. For example, one student who wasn’t sure what to do took on the role of listening and agreeing and wasn’t required to think through the mathematical ideas as they would have been required to do in the high press class.

The example above regarding the role of research in the teaching inquiry shows three things. First, it shows how reading and engaging with research is relevant to the real problems and dilemmas facing teachers; such research has been carried out in real classrooms and so speaks to real teachers. Often publication of such research includes examples, case studies, quotes, summaries, and the like that make the research particularly useful and applicable.
for practitioners. Second, it shows how such research provides insights not only into what might work by describing it, but also provides insights into how and why such strategies might work through explanations. The date of publication of the research in this example (2001) is a reminder that while there is a need to look to current and recent research, there is also a tradition of research that can be drawn on - research that strives to be useful in improving teaching and learning and also provide understanding of the deeper processes involved in teaching, learning and education (Berliner, 2004).

Learning inquiry

In the learning inquiry teachers consider the impact of their teaching on outcomes for learners. They ask about the extent to which their teaching was successful in helping students to achieve the learning established as most important in the focusing inquiry. They ask not only about student achievement or progress, but also about student experience - for example, how did the approach impact on students’ engagement, interest, motivation, enjoyment or view of themselves as learners.

There is also a need to use data gathered in the learning inquiry to consider various levels of impact - the impact on each student (how was each individual student impacted by the teaching?), on groups, classes and cohorts of students (perhaps those of special interest). Failure to consider the various levels may lead teachers to miss important cues about where their focus should be. A focus only on individual students may mask patterns in terms of groups that are responding well or not so well to the teaching. A focus on groups of learners may obscure the experience of individuals within those groups that are vital to respond to.

To be rigorous in carrying out a learning inquiry requires a focus not only on where the impact of teaching was positive (the good news story) but also attention to where the impact may not have been as positive as desired. “Which aspects of the teaching were successful?” is an important question, but equally so is “which aspects of the teaching were unsuccessful?” Similarly, while it may be tempting to notice the learners who experienced success in their learning as a result of the teaching, just as important is teacher’s attention to those learners for whom the teaching led to less success than they deserve. Noticing the impact on learners (both positive and negative) refers not only to groups of learners, but also to individuals, since there are implications for a teacher for both of those foci. In a high quality Teaching as Inquiry, having described the positive and less-than- positive impacts, teachers would then seek to explain the impact. They might ask “Why is it that my teaching was successful in one aspect, but not on the other?” and “Why is it that my teaching was less successful for one group of learners than for another?” Answering those questions calls for data of all sorts - data about student achievement gained from more formal tests and tasks, as well as qualitative accounts of student learning that might be drawn from student work samples, observations, student reflections, images, and so on.

The form of teaching as inquiry

While the sections above signal what Teaching as Inquiry is about, here we will elaborate on how it happens - the various forms of Teaching as Inquiry. Teaching as Inquiry is a means of thinking about, talking about or writing about practice. The form of each inquiry can vary in the following ways:

Duration: from short - to medium - to long - term
Participants: from the individual to the collective
Formality: from the informal to the formal
Start point: focusing inquiry or teaching inquiry or learning inquiry.

The duration of an inquiry can vary from one that happens spontaneously in relation to a short teaching instance over moments, to an inquiry into the teaching over a day, a week, a term or a school year. In a short ‘moments’ inquiry, a teacher may notice, for example, as he or she observes a discussion that students’ responses are short and rarely responded to by other students. They could then briefly contemplate how they might adapt their teaching approach to promote richer responses from students and encourage interactions between students, which may lead them to reduce the number of questions they ask during the discussion. They would then monitor the impact of their adaptation on students’ participation in the discussion that follows.

A school year-long inquiry, however, might see a teacher deciding early on in the year (based on data from her students’ previous teachers) that fractions, decimals and percentages are a priority for most of the students. That could lead to a search for research evidence about approaches most likely to improve students understanding of fractions, decimals and percentages. Consideration of that evidence would inform a plan for learning and trying various alternative approaches over the course of the year. The learning inquiry could then involve ongoing monitoring of the success of the various approaches for each student and a comparison of the overall success in teaching in this area as compared with previous years.

Teachers will sometimes carry out Teaching as Inquiry individually as they reflect, consider, wonder, plan and respond on their own. But most often inquiries will involve collaboration between teachers (often syndicate/department groups), school leaders or professional learning providers. While the guiding questions of the Teaching as Inquiry cycle are useful to teachers contemplating their practice on
their own, they are also useful to guide colleagues as they discuss each other’s inquiry. So long as such interactions are not ‘thwarted by norms of politeness and the absence of challenge’ (Timperley, 2008, p. 19) they can challenge teachers to be rigorous in their thinking, and to defend decisions that arise from consideration of the questions. A colleague might, for example, challenge a teacher’s response to the question ‘What is most important?’ by seeking their reasoning, or by prompting them to consider alternatives.

Teachers’ inquiries can also range in terms of how formal or informal they are. Many schools have adopted a formal approach to Teaching as Inquiry (see Fowler, 2012), using it as the basis for school-wide professional learning, team meetings, for teacher appraisal or mentoring. It can also be used in a much more informal manner. In this way, discussions about learning priorities, evidence-based approaches to teaching and the impact of teaching on learners become business as usual.

There is no given start point for Teaching as Inquiry. At times, it makes sense to begin with the focusing inquiry. In other situations the priority may already have been established and be quite certain, and so it makes sense for the inquiry to begin with the inching inquiry - to ask what approach/es might be most likely to work in achieving already established learning priorities. Other inquiries may begin with a learning inquiry, where a particular teaching approach has already been tried or is already in place; the important starting point question in that case may be about the impact of that approach.

**Teaching as inquiry in practice**

There has been a widespread positive response to the inclusion of the Teaching as inquiry model in The New Zealand curriculum (Sinnema, 2011). The model has been used as the organising framework for many initiatives and publications aimed at supporting curriculum implementation in New Zealand. It is the framework for a series of case studies drawn from the Quality Teaching Research and Development project (Sinnema, Sewell, & Milligan, 2011) to illustrate how teachers used an inquiry approach to become more culturally responsive and improve outcomes for their Maori and Pasifika students (Ministry of Education, 2010). It is also the main organiser in the pedagogy section of the recently revised guidelines for Education outside the classroom (Ministry of Education, 2009a) and is described as “at the heart” of curriculum guidelines for the teaching of te reo Maori (Ministry of Education, 2009b). Teaching as Inquiry has also been central to a number of national professional learning and leadership initiatives since 2007, and informed the development of an inquiry cycle in the context of teacher professional learning (Timperley et al., 2007).

The prominence of Teaching as Inquiry in policy and education initiatives and the widespread positive response to it is heartening, but there are reports of a need for greater rigour in its implementation. In a review by the Education Review Office, it was reported that while most schools had processes in place to promote Teaching as Inquiry, in 28 per cent of schools there were minimal or no processes in place. Furthermore, in schools that were promoting Teaching as Inquiry, the review revealed many approaches to be lacking rigour. For example, in relation to the teaching inquiry, ERO reported that teachers typically do not refer to research. Rather they tend to select strategies from an existing repertoire of their own practice or that of colleagues.

While there are merits to choosing known approaches, the risks are that these do not necessarily align well with the currently identified issues. Thinking about the possibilities that could lead to better outcomes for students should include looking at what other teachers and researchers have found to be effective.

They reported that there were similar gaps in the quality of inquiry at every phase.

**Collaborative inquiry**

The prominence of teaching as inquiry, together with moves in the New Zealand context to promote the role of collaboration in educational improvement has led to an increase in attention to collaborative inquiry. Many national and local initiatives foreground such collaborative inquiry, one example of which is the Teacher Led Innovation Fund.

The Teacher-led Innovation Fund (TLIF) is a Ministry of Education initiative designed to support quality practice that improves student achievement and that can be shared and adapted for use across schools and kahui ako. It is open to all primary and secondary kaiako/teachers in state and state-integrated kura/schools that meet application criteria. TLIF is one of three initiatives that are part of the broader IES Government initiative aimed at raising student achievement and strengthening teaching and education leadership. TLIF provides funding for groups of teachers to develop innovative teaching practice in order to improve learning outcomes, particularly for Maori students and Pasifika students, students with special education needs and students from low socio-economic backgrounds.

TLIF provides teachers with time and expert support to inquire into their practice to find ways to help students succeed; and to share what works with other schools and educators. TLIF aims to have long-term impacts on students, the workforce, early learning centres/schools/kura and on teaching practice.

The underpinning principles of the TLIF fund
are:

Collaborative Inquiry: groups of teachers working together to understand their practice and the impact on students.

Expertise: leveraging expertise within schools and kōhui ako, complemented by support from external experts.

Flexibility and adaptability: project teams and fund administration need to respond to change.

Knowledge mobilisation: knowledge gained from projects needs to be shared.

A recent evaluation of the initiative used a theory of action approach (Sinnema, 2018), a constraint inclusion account of problem solving. It highlighted both important areas of promise, and key challenges to such a collaborative inquiry initiative contributing to professional learning goals to improve teaching and learning.

Findings from across the data sources indicate notable successes in terms of the initiative overall, and some problematic patterns that could be addressed in ways that Continue to strengthen the TLIF initiative. The findings are summarised below.

<table>
<thead>
<tr>
<th>Problematic patterns</th>
<th>Successes and promise</th>
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<tbody>
<tr>
<td>Data confidence and capability issues</td>
<td>Overall very high regard for the opportunities presented through involvement in a TLIF project</td>
</tr>
<tr>
<td>Lower impact on teachers’ skills (in particular data use skills) or on students than on dispositions, practice shifts or knowledge and understandings</td>
<td>Big pockets of profound positivity about the TLIF experience</td>
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<tr>
<td>Discussions tended to be more supportive/collegial than challenging/rigorous.</td>
<td>Almost unanimous endorsement of TLIF</td>
</tr>
<tr>
<td>Often almost exclusive emphasis on successes and little attention to failures</td>
<td>Impact on dispositions, practice shifts and knowledge and understandings</td>
</tr>
<tr>
<td>Attention to priority learners or target groups in proposals not always carried through to the data collection, analysis and reports</td>
<td>Establishment of conditions for collaborative inquiry</td>
</tr>
<tr>
<td>Teacher confidence lower in relation to collaborative items than items relating to own inquiry and practice</td>
<td>Opportunities to make deprivatising practice and engaging in professional dialogue about it a norm</td>
</tr>
<tr>
<td>Uncertainty about the robustness of claims about the impact of innovations</td>
<td>Innovative (for the teacher/s involved) practices being tried and explored</td>
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<tr>
<td></td>
<td>Attention to student voice for insights into both teaching and learning</td>
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<tr>
<td></td>
<td>Some exceptional projects</td>
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</table>

These points are elaborated below with reference to data from the evaluation.

Successes and promise

Overall there is very high regard for the opportunities presented through involvement in a TLIF project. Teachers, project leads, and external experts were grateful for the opportunity to participate, and keen to continue.

Comments from teachers often indicated quite profoundly positive attitudes towards their experience of TLIF. Some referred to TLEF, for example, as the best professional learning experience they had ever been involved in, inspirational, a turning point, or an absolutely rewarding opportunity that was a highlight of their professional life.

Almost unanimous endorsement of TLEF from both teachers and external experts involved with project teams. When asked if they would recommend to others being involved in a TLIF project, 99.2% of teacher indicated either “yes, definitely” or “yes with some conditions”. All external experts who responded indicated similarly (100% endorsement).

The greatest impact on teachers, indicated by questionnaire ratings, was on their dispositions (6.91), practice shifts (6.79), and knowledge and understandings (6.75). Ratings for impacts on students (6.3) and skills (6.22) were “slightly lower”.

While the quality of TLIF projects is variable, in most, their efforts have resulted in improved conditions for collaborative inquiry with more regular and routine opportunities for deprivatised practice, professional dialogue about innovations being investigated, and learning from colleagues whom they had not had the chance to learn with/from before.

Many teachers reported that TLIF had provided the impetus for them to try new and different practices that were not part of their existing teaching repertoire. In many cases, the notion of “innovation” was a relative one—the practices being investigated were new to the particular teacher or group of teachers, but not necessarily highly innovative in terms of pushing boundaries or revealing practices new to the field. In some cases, highly innovative approaches were explored, offering new insights that others could learn from.

Many teachers described attention to gathering student voice for insights into both teaching and learning that they had not previously paid so much attention to. While student voice data tended to focus mostly on their preferences or satisfaction (rather than data from students about the impact of particular innovations or the reasons for the success or otherwise of an innovation) the move to include

1. Items were scored on an 8-point Likert scale ranging from ‘1’ for ‘Strongly Disagree’ to ‘8’ for Strongly agree (1); Mostly disagree (2); Moderately disagree (3); Slightly disagree (4); Slightly agree (5); Moderately agree (6); Mostly agree (7), Strongly agree (8)
The TLIF initiative has revealed some project teams with considerable expertise in leading and carrying out inquiries, learning about the impact of innovations, and mobilising knowledge from their inquiries in a way that is relevant to others. These exceptional projects provide a resource for others, and a basis for sharing not only innovative teaching/classroom practices likely to be effective, but productive processes for collaborative inquiry.

**Problematic patterns**

Data confidence and capability stands out as the biggest issue facing teachers, teams and those supporting them. Teachers themselves reported much lower confidence in their own ability to analyse data in ways that give important insights (6.18), than other aspects of their inquiry work. Those issues were also evident project reports where the quality of the data collected was often questionable, with typically generic descriptions of analyses and generality in claims about impact and causality. For example, claims like this one: “Overall the inquiry... has resulted in the uplifting of student achievement, particularly for our target students, and the teaching and learning of our teachers” were often left without evidence to support them, and no indication that data had been collected or analysed in a way that supported the claim of success.

As a consequence of the issues regarding data capability, there was often a lack of robustness in the claims able to be made about the impact of innovations on learners and uncertainty about what knowledge could be mobilised to others. Overall, teachers reported lower impact on their skills (in particular data use skills) (6.22) or on students (6.30) than on dispositions (6.91), practice shifts (6.79) or knowledge and understandings (6.75).

Discussions tended to be more supportive (7.55) or collegial (7.50) than challenging (7.17) or rigorous (7.10). That finding is important since we found a robust positive relationship between the quality of project discussions (including rigour and challenge) and impact of TLIF. That is, the better teachers rated their project discussions, the stronger they perceived the impact of the project on their knowledge (r = 0.75**), dispositions (r = 0.64**), practice shifts (r = 0.67**), skills (r = 0.55**) and on students (r = 0.59**).

The finding that there was often an almost exclusive emphasis on success and very much less attention to any failures is problematic given the likelihood of failures being associated with innovation, the importance of attention to failure and its causes to puzzles of practice, and the role of fallibility and open mindedness as disposition conducive to high quality inquiry.

Attention to priority learners or target groups evident in proposals was not always carried through to the data, data analysis and reports.

Teacher confidence lower in relation to items about ability to collaborate with (and influence) other than items relating to own inquiry and practice.

Uncertainty about the robustness of claims about the impact of innovations! Most claims were quite general—they referred to increased achievement of student! without specifying which students were impacted, in what ways, or how much their learning improved, and without sufficient supporting evidence. Some projects were further, and specified details of which students improved, how and how much. But, very few provided robust explained claims where there was, in addition, clear, logical and evidence-based explanations about how the innovation was related to improvements.

**Characteristics of Effective TLIF Projects**

Insights from the various data sources suggest that the following characteristics are associated with more effective TLIF projects. By effective, I refer to the TLIF purposes of a positive impact on outcomes for teachers (their knowledge and understanding, skills, dispositions and practice), for students (their learning experiences, relationships, and achievement), and the generation of new knowledge, understandings and learning that can be mobilised to others. These characteristics both increase the likelihood that innovations teams try are successful and, equally important, the likelihood that teams will determine, in a timely manner, when and why they are not successful where that is the case. The characteristics are:

- Unrelenting commitment to and focus on improvement—improvement of both teaching and learning;
- Levels of risk-taking and innovation appropriate to the capacity of the teachers and contexts involved;
- High quality collaboration—well-established collaboration routines and norms, that are regular, involve deprivatised practice and occur over an extended duration;
- High quality data and data analysis relevant to the logic of the innovation;
- High quality discussion—supportive and collegial and simultaneously challenging and rigorous;
- High quality expertise from internal sources (teacher leadership) and external sources (relevant quality research, and external experts whose expertise aligns with team needs).

**Enablers and barriers**

The extent to which project teams were able to carry out high quality inquiries into their innovation was influenced by a range of barriers and enablers,
summarised below:

<table>
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<tr>
<th>Barriers</th>
<th>Enablers</th>
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<tr>
<td>Logistics and project administration (including time, release issues, personnel changes)</td>
<td>Collaboration time</td>
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<tr>
<td>Resistance</td>
<td>Inquiry orientation</td>
</tr>
<tr>
<td>Data capability</td>
<td>Knowledge-building opportunities</td>
</tr>
<tr>
<td>Reporting demands</td>
<td>Contribution of external expertise</td>
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<td></td>
<td>Leadership support</td>
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</table>

Summary of Key Messages

With a focus on the purpose of the TLIF evaluation to inform continuous improvement of TLIF’s design, implementation and monitoring, the following figure presents a summary of key messages, the current ‘story’ of TLIF as it were. These messages, derived from the evaluation evidence are key because, if attended to, they hold much promise for next steps in improving the initiative overall. Some of these messages represent problems to be solved, but there are strong grounds and good conditions for solving them, given the widespread endorsement of and regard for TLIF, the establishment (or strengthening) of relational conditions conducive to inquiry and innovation, and the presence of some exceptional projects to learn from.

Implications for initial teacher education

Curriculum, inquiry and collaboration initiatives of the sort outlined above bring with them important considerations for initial teacher education. Where such initiatives prompt new and different roles for teachers, they also prompt new and different emphases and approaches for initial teacher education. In the New Zealand context, this has led to calls for a quite new emphasis for the accreditation of initial teacher educator providers, one that makes more prominent attention to the quality of assessments of graduating teacher capability than to the inputs of teacher education programmes.

The capabilities required of teachers working with curricula that promote responsive pedagogies, student agency, competencies and partnership require not only different knowledge, but different skills, attitudes and values of those who are being prepared to teach such curricula. Similarly, systems that promote teacher inquiry, and particularly those that promote collaborative inquiry need to pay attention not only to the vast potential of such approaches, but the quite particular demands such approaches have on the capabilities of teachers, including the capabilities to work in and strengthen social networks, and to interact effectively with others in ways that solve problems of practice and generate through rigorous inquiry, deep understandings about the priorities for learners, the approaches most likely to address those priorities and the impact of teaching on learning. Such demands have implications not only for the content of initial teacher education, but the processes involved in programme design, teaching, learning, practicum and assessment.

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Tóm tắt: Cải cách giáo dục và những thay đổi liên quan đến chương trình giảng dạy, phương pháp sư phạm, tiêu chuẩn, đánh giá và giáo dục nghề nghiệp có vai trò quan trọng trong các sáng kiến cải tiến giáo dục. Trong bài viết này, tôi tìm hiểu từ các sáng kiến về chính sách, nghiên cứu và thực hành trên các khía cạnh chủ yếu của giáo dục New Zealand, cải thiện những nỗ lực quốc tế để nêu bật ý nghĩa và khả năng đào tạo giáo viên. Đặc biệt, trọng tâm là cải cách chương trình học, thực hành theo hướng điều tra hợp tác: Các thành tố của chính sách này đã được phân tích và xem xét để đưa ra các hàm ý cho giáo dục ban đầu của giáo viên.

Từ khóa: Cách mạng công nghiệp 4.0; Đào tạo giáo viên; New Zealand; Cải cách giáo dục.