Project-based learning in the NCEA context: the benefits and constraints of cross-curricular implementation of project-based learning in New Zealand secondary schools.

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Abstract

Project-based learning (PBL) has been described as a future-focused learning strategy that helps to address the challenge of equipping young people with 21st century capabilities needed for a rapidly changing future. However, PBL is not commonly utilised at the senior National Certificate of Educational Achievement (NCEA) level, even though this is a crucial time for learners to prepare for a world beyond school. This thesis examines how New Zealand secondary schools could implement cross-curricular PBL in the NCEA context, what benefits and constraints there may be from a teacher and student perspective, and whether there are differences in perspectives regarding PBL in students with different levels of motivation.

The research design utilised a mixed method, multiple case study approach, where both quantitative and qualitative data was collected from three case study schools who currently use PBL at the NCEA level. Both teacher and student perspectives were gathered by an online survey in phase one of the study, followed by purposeful sampling of participants in phase two to further explore their perspectives using a semi-structured individual or focus group interview.

The research findings indicate that PBL can be successfully implemented in the NCEA context, provided key design features are in place. These include developing a strong PBL design framework, ensuring that projects have authentic purpose beyond the classroom, and fostering connections with community partners. There are clear potential benefits in engaging senior students in opportunities to participate in projects. Engagement in learning can be increased, 21st century capabilities developed, and self-regulated learning dispositions promoted. Student motivation is influenced by their ability to self-manage and they need specific pedagogical experiences that targets the development and utilisation of self-directed learning capabilities. PBL in the NCEA context is not without its challenges. These include school structural issues, the ability for schools to develop a learner-centred culture, teacher capability to project manage, and difficulties in aligning current NCEA standards with projects.

This study concludes by suggesting that schools should consider implementing PBL in the NCEA context, as part of a future-focused education orientation, as potentially there are considerable benefits to be gained.

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CHAPTER ONE: Introduction

1.1. Introduction

Future-focused discourse in education has gained an increased profile due to concerns that our current education system is not keeping pace with significant changes in global social, economic and environmental conditions. Preparing young people for an uncertain future behoves educators to review practices and consider pedagogical innovations that help to develop skills and capabilities that young people need to face future challenges.

In contrast to previous industrial economies, 21st century knowledge economies require learners to do more than just reproduce information, they need to be able to utilise it to creatively solve 'wicked' problems and actively socially construct knowledge in a rapidly changing technological era (Bolstad, Gilbert, McDowall, Bull, Boyd, & Hipkins, 2012). It is, therefore, essential that learners develop life-long learning capabilities that enable them to apply skills and knowledge flexibly in new situations. The New Zealand Curriculum (NZC) also recognises this need and outlines the vision for learners to have adaptive flexibility that allows them to be confident, connected, actively involved, and lifelong learners, who can relate well to others and be critical and creative thinkers (Ministry of Education, 2007). The NZC also has a future-focus principle for curriculum design which should "encourage students to look to the future by exploring such significant future-focused issues as sustainability, citizenship, enterprise, and globalisation" (Ministry of Education, 2007, p. 9).

Inquiry-based learning approaches such as project-based learning (PBL) are valuable as they address the challenge of equipping young people to become solution-focused knowledge builders, who are able to use higher order thinking skills to creatively co-construct innovative solutions to problems or future-focused issues (Darling-Hammond, 2008; Krauss & Boss, 2013; Student Achievement Division, 2013). PBL shares its pedagogical roots with the constructivist learning theory which perceives that learning is an active process and the learner constructs knowledge based on the experiences in which they engage (Dewey, 1916). PBL employs processes that engage learners in

actively responding to real world or authentic problems and issues, in a collaborative environment. PBL is also related to Vygotsky's social constructivist theory of learning that emphasises the social nature of learning, in which collaboration with others is a feature of the learning process and is dependent on the social and cultural context in which the learning is taking place (Schunk, 2012).

The opportunity for students to develop autonomy in their learning, competence and relatedness with others, fulfils the basic psychological needs that promote self-determination in learners (Deci & Ryan, 2002). This helps learners to become more intrinsically motivated, leading to self-regulated learning dispositions (Wentzel & Brophy, 2014).

As PBL has the potential to equip young people with future-focused capabilities, it would seem logical to use this approach at the senior secondary school level whilst learners are preparing for a life beyond school. Although there is evidence of PBL occurring in New Zealand secondary schools, particularly at the junior level, there are few schools who have implemented this at the National Certificate of Educational Achievement (NCEA) level (Education Review Office, 2018). The implementation of PBL in high-stakes NCEA contexts poses some interesting questions for school structures, teachers' pedagogy, and the potential for students to act as self-regulated learners. Currently there is minimal peer reviewed literature on PBL implementation at the NCEA level in New Zealand. Most New Zealand based literature is related to the junior curriculum in secondary schools or in primary school education.

1.2. Background and rationale for the research

NCEA was designed to support the NZC in its aims of equipping learners with 21st century skills and provide a flexible qualification system to cater for the needs of all young people (Hipkins, Johnston, & Sheehan, 2016). NCEA is comprised of standards-based assessments where learners, in their final three years of school, are assessed against a set criteria to gain an Achieve, Merit or Excellence in a standard that is worth credits. Students accrue a series of credits that are assessed internally within their school and externally by the New

Zealand Qualification Authority (NZQA), to give them a certificate of achievement at Level One, Two or Three in successive years (New Zealand Qualifications Authority, nd.).

NCEA was implemented in 2002 in response to economic and social changes in New Zealand, and has undergone various adjustments relating to the reliability and validity of the assessment tools used. Hipkins et al. (2016) suggest that NCEA, as a high-stakes assessment, can result in assessment driving the curriculum. High-stakes assessment can affect how a learner perceives the purpose of the learning and teachers can be tempted to teach to a standard to ensure students achieve the credits required. They argue however, that although the assessment is high-stakes, with the right blend of curriculum design, students can still engage in rich learning experiences. As well as the unintended consequence of NCEA assessments driving the curriculum, other issues were identified relating to NCEA as an assessment system that was fit for purpose for 21st century learners. These included concerns about a lack of coherence between the NZC and NCEA and the challenges involved in designing "coherent, flexible and inclusive senior curriculum" that has authentic contexts for assessment, empowers learners and works with communities (Education Review Office, 2018, p. 44).

The Government began an NCEA review process in 2017 to "refine and strengthen our key national qualification for young people leaving school, and to ensure that NCEA remains relevant in the modern world" (Hipkins, 2017,para. 3). The Minister of Education, Hon. Chris Hipkins, explained that the review would build on what has already been achieved with NCEA and address such issues as over-assessment, the teaching of life skills such as resilience, creativity, communication and adaptability, and the role of each level of NCEA.

The NCEA Ministerial Advisory Group released a public consultation discussion document outlining six opportunities for improving NCEA. The first of these opportunities was to create space at Level One for powerful learning. The suggestion was to reduce the credit load to 40 credits, and 20 credits would be offered as a project. This project would increase connections with local communities and offer students opportunities to explore more personalised

learning, while still acquiring the skills and knowledge needed for the future (Ministry of Education, 2018).

Although the Ministry of Education review team, in their final recommendations to the Minister of Education, did not utilise the initial suggestions, the pedagogical thinking behind the concept of offering the opportunity for students to engage with projects at the NCEA level, aligns well with future-focused thinking regarding education (OECD, 2018a).

1.3. Researcher background

As a secondary school teacher of science and biology, and a pastoral dean for many years, I have always been motivated to find innovative ways to engage students and develop their self-regulatory learning dispositions. One of the approaches that has been successful in developing these dispositions is using PBL in junior science classes. I have also used a teacher-led project in a Level Two NCEA class, focusing on an Education for Sustainability assessment standard. Students undertook projects where they developed and carried out their action plans based on their questions and findings about the health of their local environment. Although I recognise the benefits in utilising PBL at the senior level, time and school structural constraints (such as the timetable) limited my ability to use this strategy in other classes and in a cross-curricular manner. My preliminary readings when researching PBL as a classroom teacher, revealed that there are some schools in New Zealand who have, as part of their senior school, timetabled passion or impact projects as part of their senior school. However, most exemplars regarding PBL in New Zealand relate to the primary school or at the junior secondary school level. It is my intention that this research will provide some evidence-based insights that will help to add to the growing understanding of PBL implementation at the NCEA level, especially in ‘ordinary’ Year 9 to 13 secondary schools.

1.4. Aim of the research

This thesis seeks to examine how PBL can be implemented at the NCEA level in New Zealand secondary schools and considers the benefits and constraints that are associated with this implementation.

It is intended that the findings of this research will help to gain an understanding of the perspectives that teachers and students have towards PBL, and the way in which PBL is being implemented at the NCEA level.

Research Questions:

- How can cross-curricular project-based learning be implemented at the NCEA level in New Zealand secondary schools?

- What are the benefits of implementing cross-curricular project-based learning in the NCEA context, from a student and teacher perspective?

- Are there differences in perspectives about project-based learning in students with high motivation levels compared to students with lower motivation levels?

- What factors enable or constraint the implementation and enactment of cross-curricular project-based learning at the NCEA level in New Zealand secondary schools?

1.5. Structure of the thesis

This chapter has outlined the purpose of the research and gives an overview of the reseach context. In Chapter Two a review of current literature will be undertaken, with an emphasis on PBL in the senior secondary school environment. Chapter Three outlines the methodology that underpins the research and the procedure that was used to collect and analyse the data. Chapter Four presents the findings for the three case study schools and the cross case analysis that reveals key themes. These themes are discussed in Chapter Five, followed by Chapter Six, with a final conclusion, recommendations for future research, and limitations.

CHAPTER TWO: Literature review

"Education is not an affair of 'telling' and being told, but an active and constructive process" (Dewey, 1916, p. 46).

2.1. Introduction

Project-based learning (PBL) is a learning approach that has the potential to be a motivating experience for learners as it incorporates opportunities for learners to develop many of the key competencies and skills needed to become the innovative, collaborative problem solvers of the future (Barron & Darling-Hammond, 2008a; Bell, 2010; Bolstad et al., 2012; OECD, 2018a; Thomas, 2000).

This chapter seeks to present how PBL is defined in the current literature and outlines what is considered as key design elements in PBL. It then outlines what educational researchers consider as essential 21st century skills that learners need to develop to be effective life-long learners. It then examines what the literature says about how these skills can be developed by using the PBL approach and the benefits associated with this. The chapter will conclude by examining what the literature reveals regarding how PBL can be implemented effectively in the school setting, and the perceived PBL challenges that may affect its enactment by teachers in their classrooms.

2.2. What is PBL?

PBL, as a subset of inquiry-based learning approaches, typically involves the learner self-directing and engaging in a series of authentic, meaningful, and complex learning tasks that are guided by the teacher (Barron & Darling-Hammond, 2008b; Bell, 2010; Holm, 2011; Thomas, 2000). Central to PBL is an emphasis on students having autonomy to make decisions about the direction of their project (Thomas, 2000).

PBL begins with a student-generated driving question and uses an integrated curriculum approach to investigate the question, issue, or problem. In this way the teacher facilitates the process but the learner is in the 'driver's seat' and is guided through each step of the process by the teacher (Bell, 2010). Rather than research a theme and report back on known facts, the PBL approach

requires learners to build on their pre-existing knowledge to construct new knowledge and think critically (Bell, 2010; Boss & Larmer, 2018; Krauss & Boss, 2013). This results in deeper learning and understanding (Bell, 2010; Boss & Larmer, 2018; Krauss & Boss, 2013).

PBL requires careful design in order to promote meaningful learning. The project needs to be relevant and have meaning for the student with a clear educational purpose (Larmer, Mergendoller, & Boss, 2015). The 'Gold Standard' essential project design elements of PBL include the development of a significant, authentic, driving question that is connected to the real world (Larmer & Mergendoller, 2015). This leads the student to develop a challenging and sustained inquiry to encourage them think deeply and critically about the knowledge and understanding that they gain (Larmer et al., 2015; Thomas, 2000). The authentic aspect is important as it gives the opportunity for students to engage in real-world contexts, that are of personal interest and concern (Boss & Larmer, 2018). It should be student driven, allowing for student choice and promote the social construction of knowledge, communication and collaborative skills, and self-management (Bell, 2010; Larmer et al., 2015; Thomas, 2000). Finally, the process should include formative feedback from peers and adult mentors to promote reflection and self-assessment that helps students to refine their projects and produce high quality end products (Larmer et al., 2015). There should be a final outcome which could be a product (artefact), performance, or action produced that demonstrates the students' new understandings (Helle, Tynjälä, & Olkinuora, 2006). Students can then publicly present their work, which imparts a sense of pride and develops presentation skills (Larmer et al., 2015).

Essential to effective project-based learning is the role of the teacher in how they create meaningful and challenging project environments for the students. PBL may require some reframing of thinking relating to the level of teacher control in the classroom. However, this does not mean an abdication of responsibility for learning outcomes as teachers have an important role in guiding and coaching students to help them navigate their way through the various stages of the project. This is achieved by the teachers adding layers of support to enhance the students' learning (scaffolding) and utilising a variety of

instructional strategies. This includes giving formative feedback, supporting skill acquisition, and developing self-assessment ability (Helle et al., 2006; Krajcik & Shin, 2014; Krauss & Boss, 2013; Larmer et al., 2015).

2.3. Relevance of PBL in the 21st century learning context.

Hannon (2015) asks what learning is for and contends that learning in today's context should be about addressing the challenges we face as a species and determining how to collectively develop conditions in which we can lead fulfilling lives as a community. Hannon (2015) contends that our current education system does not adequately address these issues and requires a radical overhaul. New Zealand educators have also joined the future-focused orientated learning discourse in recognising that our education system needs to shift to provide a more coherent learning environment and re-evaluate the purpose for learning in a changing world (Bolstad et al., 2012; Claxton, 2012; Education Review Office, 2018). Implicit in redesigning of education systems is the introduction of innovative pedagogies. This sentiment is echoed in the OECD's (2018b) publication on innovative pedagogies which lists six clusters of pedagogies that teachers could use to develop innovative strategies in the classroom. One of these clusters is "Experiential learning: Inquiry in a complex world" (OECD, 2018b, p. 3). This uses PBL as an example of an effective strategy that helps students develop 21st century capabilities.

Compared to last century, some educational researchers believe that the skills and capabilities essential for people to function effectively in the workforce, to be contributing citizens, and to become self-actualised are very different in the 21st century (Dede, 2010; McKellar, 2012; Trilling & Fadel, 2009). The shift from an industrial age economy to a knowledge age economy has resulted in knowledge work increasing. This requires workers to have higher levels of communication and thinking skills in order to create new products and solutions for future problems (Nieveen & Plomp, 2017; P21, 2007; Trilling & Fadel, 2009). Sardar (2010) refers to how we now live in post-normal times, where we are in a transitional period in which the world is in constant change and uncertainty due to the effect of globalisation, environmental crises, social and economic upheaval, and the knowledge economy. Sardar (2010) contends that the most

essential capability needed for coping with post-normal times is having imagination and creativity. It is, therefore, essential that students develop 21st century skills and capabilities to meet the demands of a rapidly changing environment of work and society in the future, to have adaptive expertise, and life-long learning dispositions (Bolstad et al., 2012; Gilbert, 2014; P21, 2007; Trilling & Fadel, 2009). Preparing students for this rapidly changing world is one of the big challenges of education in the 21st century (Trilling & Fadel, 2009).

The OECD have defined 21st century skills and competencies as " those skills and competencies young people will be required to have in order to be effective workers and citizens in the knowledge society of the 21st century" (Ananiadou & Claro, 2009, p. 8). Not surprisingly, employers have an interest in education providing them with future employees who have many of the 21st century or 'soft' skills. A recent 2018 QS Global employers survey of more than 11,000 employers from around the world, indicated that the development of 'soft skills' in prospective graduate employees was almost equally important as any technical or disciplinary knowledge (Chang, 2018). The top twelve skills ranked as most important were problem solving, teamwork, communication, adaptability, data analysis, resilience, organisation, technical skills, creativity, leadership, language, and commercial awareness (Chang, 2018).

The New Zealand Curriculum (NZC) document (Ministry of Education, 2007) makes reference to the 21st century skills by listing five key competencies that are considered to be capabilities for living and lifelong learning. The rationale for this is explained as "people use these competencies to live, learn, work, and contribute as active members of their communities. More complex than skills, the competencies draw also on knowledge, attitudes, and values in ways that lead to action. They are not separate or stand-alone. They are the key to learning in every learning area" (Ministry of Education, 2007, p. 12). The key competencies are:

- thinking
- using language, symbols and texts
- managing self
- relating to others

- participating and contributing

Regardless of the way in which the 21st century skills are categorised and described, it is clear that they are not stand alone subjects in curricular. They are also not entirely comprised of skills, as many emphasise values and learning dispositions such as resilience and creativity. Saavedra and Opfer (2012) note that these skills are more demanding to teach than the more traditional didactic, knowledge transmission style of teaching. PBL has been reported as a pedagogical approach that promotes the development of key competencies or 21st century skills, particularly skills in communication, collaboration, problem solving, critical thinking, creativity, and managing self (Barron & Darling-Hammond, 2010; Bell, 2010; Hixson, Ravitz, & Whisman, 2012; Lattimer & Riordan, 2011; Meyer & Wurdinger, 2016; OECD, 2018b; Thomas, 2000).

2.4. Benefits of PBL

PBL is described as a pedagogy whereby students develop deeper and more meaningful learning as they actively engage in sustained project work in an authentic context (Barron & Darling-Hammond, 2008b; Krajcik & Shin, 2014). This indicates that there are many potential benefits in implementing this pedagogy in secondary schools. Research in PBL in the last twenty years has revealed promising merit in enacting this pedagogy in educational settings, although there is some debate on the validity of measures used to assess effectiveness of the 21st century competencies that PBL develops (Condliffe, Quint, Visher, Bangser, Drohojowska, Saco, & Nelson, 2017). Condliffe et al. (2017) also state it can be difficult to make generalisations about PBL's effectiveness due to the variation in the enactment of PBL in schools. Much of the PBL research at the secondary school level arises from studies of schools in the USA and there are currently minimal peer reviewed research about PBL implementation in New Zealand secondary schools. Key evidence from peer reviewed research about the benefits of PBL have been summarised into the following two main areas.

Increased cognitive and critical thinking skills and promotion of skills needed for innovation

Thomas's (2000) review of research on PBL concluded that in comparison to other instructional methods, there was some evidence that engaging in PBL enhances the quality of learning due to developing higher cognitive skills during PBL. Thomas (2000) states that this increases the ability of the learner to apply their understanding in new problem solving situations. He also reports that PBL is at least equivalent to, or slightly better than, other instructional methods in increasing general academic achievement. A literature review by Condliffe et al. (2017) on PBL notes that much of the research on PBL effectiveness arises from the STEM subjects (science, technology, engineering and mathematics). Some secondary school examples of this include Geier, Blumenfeld, Marx, Krajcik, Fishman, Soloway, and Clay-Chambers (2008) study of middle school students participating in PBL in science that showed an increased science content understanding and higher pass rates on standardised state tests than their contemporaries who had not participated in PBL. Holmes and Hwang (2016), in their longitudinal study on the effects of PBL in secondary mathematics education, showed that the achievement gap between students with previously different achievement levels was significantly reduced and the PBL approach was equally effective for students with different levels of mathematics understanding. In particular, they noted that the PBL students demonstrated a greater ability to think critically and that the approach had noticeable benefits for at-risk and minority students. Similar results were found in a longitudinal study based on achievement gains using PBL in social studies, career readiness (Summers & Dickinson, 2012), and in middle school history (Hernández-Ramos & De La Paz, 2009).

As Bolstad et al. (2012) notes, in the knowledge age, rather than just knowing the 'what' of knowledge, learners need to know the 'how' of knowledge, and be able to flexibly apply knowledge and transform it into new ideas, in order to creatively and collaboratively solve future 'wicked' problems. Bereiter and Scardamalia (2014) describe how knowledge creation results from purposeful knowledge building through learners' collectively and collaboratively improving simpler ideas to produce more complex and creative ideas. They explain that

educators should encourage design thinking mind-sets with learners. These mind-sets are innately social and by developing a community knowledge-building ethos, it will habituate the mind-set in learners to always seek to refine ideas and help to create a culture of innovation (Bereiter & Scardamalia, 2014). A PBL learning environment allows for students to engage in meaningful problems and encourages investigation of questions, which provokes discussion and challenging of their ideas and those of others (Krajcik & Shin, 2014). This promotes Bereiter and Scardamalia's (2014) design thinking mind-set in learners. Wagner and Compton (2012) also described PBL as a curricular structure that promotes innovation and creativity.

Increased motivation and development of student agency and self-regulatory skills

Holm (2011) notes in her review of the effectiveness of PBL instruction from prekindergarten to 12th grade classrooms, that in all studies where data on student attitude was gathered, PBL was positively regarded and led to greater engagement with subject matter due to the learner-centred approach. Evidence of increases in the level of intrinsic motivation of high school students engaging in PBL have also been reported (Barak & Asad, 2012; Doppelt, 2003; Holmes & Hwang, 2016; Lam, Cheng, & Ma, 2009). Interestingly, Lam et al. (2009) also found that students reported a higher level of intrinsic motivation and felt more supported in the PBL environment where their teacher also reported a high level of intrinsic motivation.

Motivation is a set of values and beliefs that steers achievement behaviour and can be inferred from a learner's actions such as the choice of tasks they engage in, the persistence of physical and cognitive effort made, and can be viewed as a mix of individual, social and contextual factors (Schunk, Meece, & Pintrich, 2014; St George, Riley, & Hartnett, 2014; Stipek, 2002; Wentzel & Brophy, 2014). Ryan and Deci (2000) developed a self-determination theory which explains that intrinsic motivation is heightened when the learning environment offers autonomy in learning choices, enables learners to develop competence, and allows for relatedness to others by providing opportunities to collaborate with other learners. Bell (2010) explains that the choice or autonomy element in

PBL is crucial to empower learners to make their own learning decisions and with scaffolded support, learners become more independent and responsible for their own learning. She also notes that “PBL promotes social learning as children practice and become proficient with the twenty-first-century skills of communication, negotiation, and collaboration” (Bell, 2010, p. 40).

One of the key aspects that helps students in the senior secondary school to develop these 21st century capabilities and life-long learning attributes is to have learning environments that promote learner agency (OECD, 2018a). When a learner is agentic it means they have ownership of the learning, are able to self-regulate in specific contexts, and be actively involved in the decisions about their learning (Vassallo, 2013). Key design features of PBL include the opportunity for learners to have autonomy to self-direct and make decisions about the direction and outcome of their projects (Bell, 2010; Larmer & Mergendoller, 2015). It is contended in this thesis that the development of self-direction or self-regulation in learners is one of the central goals of education. One of the NZC’s guiding principles is “the curriculum encourages all students to reflect on their own learning processes and to learn how to learn” (Ministry of Education, 2007, p. 9). The learning to learn concept is described as having autonomy or self-regulation of learning and is related to the competency of managing self (Ministry of Education, 2012). Vanasupa, Stolk, and Harding (2010) propose that learning environments that meet a learner’s self-determination needs of autonomy, competence and relatedness will also promote the opportunity for learners to develop self-regulation.

Self-regulated learning (SRL), as a concept, has been extensively researched over the last few decades. Zimmerman (2002, p. 65) describes self-regulation as “self-generated thoughts, feelings, and behaviours that are oriented to attaining goals.” Being self-regulated increases interest, motivation and self-efficacy beliefs, helps the learner to make causal attributions related to strategies that are selectively used to achieve results, and utilise adaptive learning methods as a result of their self-reflection (Zimmerman, 2002). Pintrich (2004) developed a model of the self-regulatory process similar to Zimmerman. Pintrich’s model is unique, however, as it relates the learner’s attempt to control behaviour to the learning context, which is useful in analysing SRL in PBL

environments. It is noted that the SRL phases in Pintrich's model such as planning, monitoring, control of selection of cognitive strategies and reflecting, that are all processes required to promote SRL in learners, are also part of the Larmer and Mergendoller (2015) essential elements of effective PBL design. This suggests that when PBL is designed effectively it may help to develop self-regulation in learners.

Pintrich's model was developed after gaining empirical data from his Motivated Strategies for Learning Questionnaire (MSLQ), which is now one of the most utilised instrument in SRL measurement (Panadero, 2017). Stolk and Harari (2014) used Pintrich's MSLQ questionnaire to investigate the extent in which motivational variables in self-regulation such as goal orientation, self-efficacy and identified value to the task in PBL classrooms, predicted the engagement in the cognitive strategies of elaboration, and critical thinking in engineering students in a USA undergraduate college. The study found that there are several motivational variables, especially task value, that were significant predictors of the students' use of elaboration strategies in the PBL course. Stolk and Harari (2014) hypothesised that the PBL course gave the opportunity for students to select personally relevant and real-world projects that helped them to value the learning, and therefore, use and develop deeper cognitive strategies. Other studies reported that PBL has a positive impact on developing self-directedness, amongst other skill development such as responsibility, problem-solving, work ethic, communication, and creativity (Meyer & Wurdinger, 2016; Wurdinger & Qureshi, 2015).

English and Kitsantas (2013), however, caution that the skills required to be a self-regulated learner do not come naturally so teaching practices need to be designed to support the development of self-regulated learning, if PBL is to be successful. They advise that the teacher's role in PBL is to "structure activities to stimulate motivation and encourage reflection, and to facilitate learning through scaffolding, feedback, guidance, and prompts for learning" (English & Kitsantas, 2013, p. 131). Holmes and Hwang (2016) study on PBL in secondary mathematics classrooms showed that initially some students needed an adjustment period to become more self-disciplined learners but over time

group work helped students to become more self-regulated and work more autonomously with the group to set goals, value the task and seek help from their peers. They also concluded that the academic performance improved as a result of the role-assigned participation within the group.

2.5. Opposition to PBL

Not all educators, however, are convinced that there are benefits in using PBL as an innovative pedagogy. Christodoulou (2014) argues that myths exist about education, particularly relating to disciplinary knowledge when the learning of facts are considered as being of little importance. She argues that learner-centred strategies, such as PBL, undermine a student's ability to be able to think critically as they do not have discipline or domain-specific knowledge from which to make meaning.

This notion of disciplinary knowledge seems to be the contentious issue in the 21st century learning debate. The OECD (2018a) is quite clear in its vision for the future that it is essential for future-ready students to build a solid foundation where literacy and numeracy competence is crucial. It states that disciplinary or declarative knowledge is still important as it is the raw material with which to create new knowledge, as well procedural knowledge (how something is done), and epistemic knowledge (or knowing how we know) (OECD, 2018a). Johnston, Hipkins, and Sheehan (2017) state that developing epistemic thinking in learners is essential, particularly when they are carrying out open-ended guided inquiries across disciplines.

Some New Zealand university academics have voiced concerns relating to disciplinary knowledge and PBL. One concern is that disciplinary knowledge relating to specialist areas may be diluted if project work is introduced at the NCEA level, causing students to be ill-prepared for further study and work (Gerritsen, 2018). Another concern relates to the place of disciplinary knowledge, with the belief that academic knowledge or 'knowledge-that' should come before projects are undertaken (Rata, 2018). McPhail (2018) warns that learning approaches that connect learners with real world experiences do not necessarily develop the disciplinary thinking that will generate the critical thinking necessary to be innovative problem solvers for real world problems. He

advises that approaches to curriculum should first embrace disciplinary understanding and then move to interdisciplinary learning as a method of productive curricular organisation.

Hmelo-Silver, Duncan, and Chinn (2007) point out however, that some researchers tend to group approaches like PBL with unguided discovery learning. They emphasise that PBL approaches should be highly scaffolded, with support from teachers, as this may reduce the students' cognitive load and make disciplinary thinking and strategies explicit, helping them to learn the content knowledge and epistemic practices required.

2.6. PBL implementation into school structures and the enactment of PBL by teachers in their classrooms.

Research, particularly from the USA, has shown that there are challenges in the implementation of PBL into school structures and the depth and quality of PBL implementation can vary from school to school (Condliffe et al., 2017). Alongside this is the variation in enactment of PBL by teachers, possibly due to the lack of consensus about what a quality PBL approach should look like in the classroom (Condliffe et al., 2017; Tamim & Grant, 2013). The next two sections deal with issues relating to PBL implementation into school structures, followed by PBL enactment by teachers in their classrooms.

PBL implementation into school structures

Minnesota New Country Secondary School in the USA, uses the self-directed, learner-centred PBL approach as the basis for all learning experiences, except for mathematics, and students design their own projects in order to meet the state standards (Aslan & Reigeluth, 2015). Aslan and Reigeluth (2015) carried out their study in this school to examine the challenges of learner-centred education and concluded that if schools want to adopt this approach they must be prepared to help students develop a different mind-set about their education. Schools should address structural issues, such as time needed for monitoring student progress, and assessment difficulties relating to assessing project artefacts. They conclude by stating that " the greatest challenge of all is for

educators and policy makers to understand that piecemeal reforms cannot meet our current educational needs" (Aslan & Reigeluth, 2015, p. 68).

If schools adopt learner-centred PBL as their main form of instructional approach rather than a didactic transmission mode, there are significant challenges to address. Schmuck and Runkel (1994) contend that if there is major innovation in curriculum it requires alterations in the educational organisation's structures and culture of the school. For a school to become self-renewing there has to be an openness to change and an organisational adaptability. Schmunk and Runkel (1994) note that productive change is unlikely unless staff members acknowledge the need for a change to occur. Fullan (2007) calls this shift in culture as 'reculturing' and considers the role of an effective leader in this process as one who helps the members of the staff to commit to the change by establishing a moral purpose. He also states that the leader needs to understand the change process and create opportunities for knowledge creation, relationship building and coherence making.

Ravitz (2010) conducted a study into small reform-orientated high schools that have changed their mode of instruction to include PBL, to enquire into how cultural and instructional reforms differ across the school types. Data was gathered from 395 teachers who taught in schools that invested in PBL related practices ranging from large, comprehensive high schools to smaller schools and those from specific reform model networks, such as New Tech High and Envision schools, that have a holistic PBL approach. These reform model schools are affiliated to organisations like the Buck Institute of Education that support PBL implementation and provide professional learning or professional development communities. Ravitz (2010) found that even though all teachers used PBL to some extent, the teachers in small reform model schools used PBL at least half the time compared to 18% of the time in small schools and only 6% in large comprehensive high schools.

The study also showed that small schools that are 'start-up' in development rather than 'conversion' schools to the PBL approach are more successful at implementing the PBL model. Although reform schools showed significant changes in teacher culture (e.g. teacher collaboration, decision-making) and

student culture (e.g. student personalisation and pro-learning attitudes), compared to large schools, the smaller schools showed a change in teacher culture similar to the reform schools. Ravitz (2010) hypothesised that this may be due to the ease in which teachers in a smaller school can interact and collaborate together, particularly if the school is 'start-up'. He also concluded that the power of having a small reform school PBL model is that there is a unified vision for instructional change, with the resources and leadership support to implement PBL and overcome challenges. The resulting effective use of PBL has a synergistic effect on culture, as the cultural change in the school that enables PBL to be enacted effectively, reinforced the positive change in both student and teacher culture (Ravitz, 2010). This suggests that PBL implementation is more successful or easier if there is a shared vision that is aligned with school culture and mandates, with sufficient support for professional learning and resources, and is encouraged by school leadership.

An Australian study reflecting on the evolution of PBL implementation in a Sydney high school reiterates these factors and adds that building a culture within the school where learner-centred education was evident, such as the language the teachers and students used aligning with the PBL pedagogy, was imperative (Hendry, Hays, Challinor, & Lynch, 2017). They also reflected that for meaningful change to occur it needs to happen throughout the school, rather than in just a few classrooms, to allow strategic resourcing and structural factors to support the changes (Hendry et al., 2017). Even with these factors attended to, ongoing challenges remained particularly relating to the need for continued differentiated professional learning to occur to support teachers to use PBL. Further challenges included how to adapt the content-rich syllabus designed for more didactic modes of transmission, to a PBL environment where students drive more of their own learning (Hendry et al., 2017).

A study relating to transforming pedagogies and PBL by Dole, Bloom, and Kowalske (2015) concurs with these findings and notes that it can be risky to change one's practice. If teachers need to meet the demands of high-stakes assessment and standardised tests they may feel the pressure to use more traditional pedagogies that require less time management and gives them more control over the pace and content of the instruction that will be measured by the

assessment or test (Bradley-Levine, Berghoff, Seybold, Sever, Blackwell, & Smiley, 2010; Dole et al., 2015). A study of PBL implementation in a local school district in the Midwest of the USA, concluded that a sustainable change towards PBL requires a commitment from parents and a wide variety of partners "who are willing to change their paradigms of education along with the students, teachers and administrators in the school" Bradley-Levine et al. (2010, p. 22). The authors also state that there needs to be the creation of alternative models of assessment as it is not fair to ask teachers to 'straddle' two different paradigms and this has implications for the need to develop new accountability systems.

As PBL gives students opportunities to develop many 21st century skills or competencies, assessments should reflect the students' performance in these skills and their ability to apply their knowledge, self-assess and reflect on what they have learned (Bell, 2010; Boss, 2012). Hixson et al. (2012) found in their three-year study of professional development in PBL and the impact on 21st century teaching and student achievement, that while teachers felt confident in developing the 21st century skills in their students, they were less able to effectively assess them. Hixson et al. (2012) recommended the need to develop assessments that are more closely aligned to PBL and 21st century skills.

Student competencies in 21st century skills are more difficult to assess and, similar to other countries, New Zealand currently does not have an assessment system that acknowledges student competencies in this area. Hipkins and Cameron (2018), in their review of trends in assessment, note that the curriculum needs to underpin assessment and we should assess what we value most. They state, however, that what we value is changing and more research is needed to increase our understanding of how best to address this. The authors also acknowledge the challenge of making curriculum the driver of assessment rather than the tendency of high-stakes assessments becoming the curriculum that is enacted in the classrooms. They summarise by saying that "given the rapid evolution of curriculum thinking internationally, commonly used assessment tools and practices are lagging behind. The need to expand and adapt assessment practices to gather evidence of '21st century' outcomes lies at the heart of the alignment challenges" (Hipkins & Cameron, 2018, p. 25).

Hipkins et al. (2016) suggest that NCEA already gives New Zealand secondary schools a flexible standards-based assessment system that can be used to offer rich learning experiences with the right curriculum blend. There are standards that could be used to assess PBL in a generic manner but as a principal's submission in the NCEA review report suggests, "that a suite of standards could be created to assess inquiry, collaborative problem solving and communication" (NZCER, 2018, p. 48). The Ministerial Advisory Group to the NCEA review also suggested developing NCEA standards that were specific to PBL (Ministry of Education, 2019a). This suggests that before PBL gains traction in the New Zealand context, changes in assessment practices for PBL at the NCEA level are needed.

PBL enactment by teachers in their classrooms

Enacting PBL requires a shift in practice, due to its learner-centred orientation, especially for those who are more familiar with teaching in traditional settings (Boss & Larmer, 2018; Ertmer & Simons, 2006; Thomas, 2000). Barron and Darling-Hammond (2010) maintain that the success of PBL is highly dependent on the knowledge and skills of the teachers enacting it. They report that the inquiry approach needs to have extensive scaffolding with constant formative assessment and redirection as the students' projects develop in order to avoid completing projects for the sake of completion, without meaningful understanding. Teachers also need to develop classroom norms that guide learner participation and accountability, create a culture of collaboration, and adjust to the changing role of facilitating rather than directing the learning (Barron & Darling-Hammond, 2010; Ertmer & Simons, 2006).

Critical to the ability to shift teaching practice and develop a PBL approach in the classroom is the teachers' beliefs about pedagogy and whether they believe that a learner-centred approach optimises learner outcomes and fosters 21st century skills (Rogers, Cross, Gresalfi, Trauth-Nare, & Buck, 2011; Tamim & Grant, 2013). Rogers et al. (2011) study of teachers engaged in the first year of PBL implementation concluded that teachers' openness or resistance to changing their thinking or orientation towards teaching and learning depended on their professional experiences. They recommend that ongoing and intensive

professional development needs to occur, not only to support understanding of PBL processes, but also to address established teaching and learning beliefs. Dole et al. (2015) study found that professional learning experiences that were active, supportive and in-situ with students, promoted changes in beliefs and increased confidence in enacting PBL approaches in the classroom. “Telling teachers to change how they teach is not always successful. Experience is the best teacher.”(Dole et al., 2015, p. 12). Wolking (2018), in describing considerations for implementing project learning on a larger scale in New Zealand, stated that training needs are likely to be substantial and schools would be reliant on service providers to provide training. However, Wolking (2018) states there are no service providers in New Zealand who have significant expertise in project-based learning. Wolking (2018) suggests some training areas could include how to help teachers effectively manage projects and be able to have coaching conversations with students.

Although there are now good models of what a quality PBL design looks like (Larmer & Mergendoller, 2015), there is still debate about how it should be enacted in the school environment (Tamim & Grant, 2013; Thomas, 2000). Bell (2010) and Thomas (2000) suggest that authentic PBL is central to the curriculum and is the primary vehicle for learning, not a supplementary activity that supports learning. Tamim and Grant (2013), however, found that there are differences in the way in which teachers used or enacted PBL in the classroom and concluded that although all teachers in the study embraced PBL as an effective learning strategy, how they enacted it depended on their beliefs about where PBL was most effective in the learning process. Condliffe et al. (2017) suggests that without a clear idea of how PBL should be enacted, it is difficult for teachers to know whether the version they are using is effective. Their literature review on PBL took a macro view of PBL approaches and categorised the way in which PBL enters the classroom into three groups. Firstly, where PBL is enacted by an externally developed curricular, secondly, when it is teacher-initiated through teachers designing and enacting their own approach, and thirdly, by a whole school approach where students are exposed to PBL across disciplines (Condliffe et al., 2017).

In New Zealand secondary schools, PBL has gained some traction when it is enacted as a whole school approach such as at Albany Senior High School. Hipkins (2011) review on Albany Senior High School described how all students undertook an Impact Project of their own choosing, once a week, working individually or as a group. Students liaised with a teacher whose expertise could best support their learning and enlisted community contacts to help with their projects.

2.7. Summary

This chapter has outlined the current research regarding PBL and its implementation in secondary schools. The PBL approach has the potential to offer many benefits as it offers a meaningful and personalised opportunity to engage the learner and develop important 21st century 'soft' skills and deeper understanding, in authentic contexts. However, the implementation of PBL in schools and the enactment of it in the classroom needs careful design and challenges exist that must be overcome in order for the PBL approach to be successful. There is a plethora of literature from the USA that has guided the implementation process and there are well-developed external providers of support and expertise in PBL in the USA. There is an increasing interest in using the PBL approach in senior secondary schools in New Zealand due to the desire to develop more future-focused education opportunities, as evidenced by the initial NCEA review suggesting a project opportunity at Level One. Research regarding how PBL could be implemented and enacted in the New Zealand secondary school setting is scarce and documentation on shared practice and the challenges they faced, by the few schools currently using PBL at the NCEA level, would be beneficial.

The next chapter describes the methodology and procedure that was used to gather and analyse the data collected in the research.

CHAPTER THREE: Methodology

3.1. Introduction

This chapter outlines the theoretical framework that has guided the approach to this research. It explains why a multiple case study, mixed method design was used and describes the data collection and analysis utilised to gather and process the data. It also outlines considerations that were made to ensure the trustworthiness of the methods used and that ethical issues were addressed. It then concludes by describing the procedure that was undertaken to collect and analyse the data.

3.2. Theoretical framework

Due to the influence of philosophical worldviews on research it is important for the researcher to make their philosophical stance explicit (Creswell & Creswell, 2018). One worldview or paradigm that exists proposes that the human reality is socio-culturally constructed by groups of individuals and varies depending on the context the individuals are situated in (Lincoln & Guba, 2013). Researchers, therefore, would need to seek to understand the complexities of the meanings individuals make about their experiences, taking into account that the research participants may have multiple views relating to situations, based on their different experiences (Creswell & Creswell, 2018; Lincoln & Guba, 2013). This paradigm is called social constructivism or interpretivism and the researcher gathers qualitative data to make sense and inductively interpret meanings based on the views individuals have about the contexts they are in (Creswell & Creswell, 2018; Willis, 2007). As the interpretivist researcher emphasises the understanding of realities from multiple viewpoints rather than a single unique truth, the outcome is rich data that helps the researcher to build a greater understanding of the context that is being studied. This worldview will guide this study to help understand multiple viewpoints regarding project-based learning (PBL), from participants in specific school-based contexts, at a specific point in time.

This study will also take a pragmatic approach in order to utilise methodologies that best suit the research problem (Creswell & Creswell, 2018). A pragmatic epistemology emphasises the relationship between knowledge and action, in

that knowledge construction is useful to the researcher in terms of guiding and developing action (Goldkuhl, 2012). The pragmatic approach allows the researcher to assess the practical consequences of employing data collection methods in the context in which it is gathered. Rather than focusing on gathering either numeric or narrative data, pragmatists action the combination of data collection methods that are most appropriate to practically address the needs and purpose of the study (Creswell & Creswell, 2018; Feilzer, 2010; Goldkuhl, 2012; Johnson & Onwuegbuzie, 2004). Due to the complexity of education settings, while recognising that gathering data qualitatively will assist understandings from those engaged in the phenomenon, a pragmatic approach will allow this study to utilise different data collection methods from a quantitative paradigm, as this will increase the ability to seek multiple viewpoints. This helps to increase the depth of understanding of the research problem in comparison with using only one data collection method (Creswell & Creswell, 2018). The multiple viewpoints gathered numerically from participants regarding PBL in an NCEA context will be used to enrich the narrative data collection, in keeping with the interpretivist worldview.

3.3. Mixed Methods methodology

Mixed methods research is where researchers use both qualitative and quantitative research approaches in data collection, analysis, and inference in order to add depth to the understanding of a study (Creswell & Plano Clark, 2018; Johnson, Onwuegbuzie, & Turner, 2007). By including both quantitative and qualitative methods in the research design, the strengths of each are maximised and their unique weaknesses are compensated by each type of method (Johnson et al., 2007; Plano Clark & Ivankova, 2016). Central to the mixed methods research design is the integration of the qualitative and quantitative data at either the collection stage or in the analysis or inference stage (Creswell & Plano Clark, 2018). The data sets can be integrated by merging the data to build the data set, connecting the data by analysing one dataset to then inform the collection of the subsequent data collection, or embedding the data within a larger design (Creswell & Creswell, 2018; Creswell & Plano Clark, 2018). Depending of the nature of the research problem, the quantitative and the qualitative components may have different status and the

timing of components may also differ as data could be collected concurrently or sequentially (Johnson & Onwuegbuzie, 2004).

In this study, the mixed methods design will be an explanatory sequential design where quantitative data will be collected first that will inform the purposeful sampling of individuals in the subsequent qualitative phase (Creswell & Creswell, 2018; Creswell & Plano Clark, 2018).

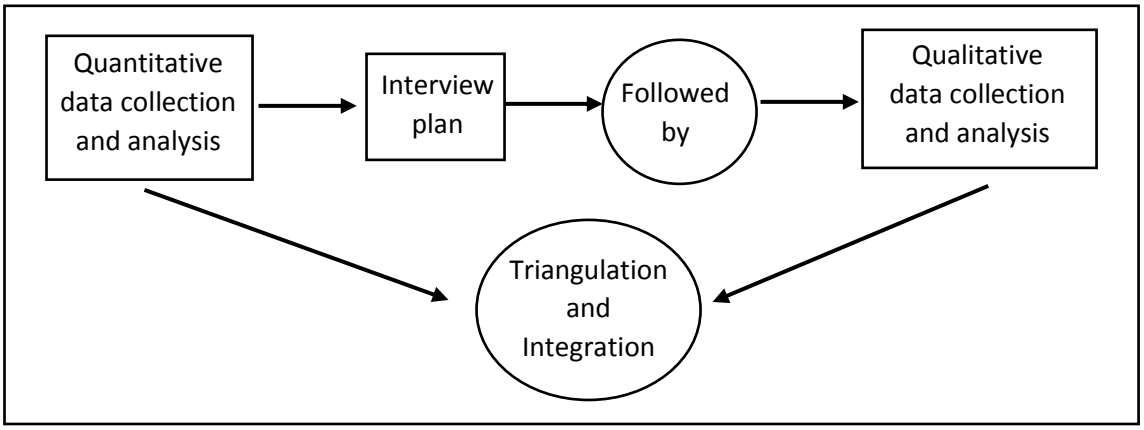

Figure 3.1 Explanatory sequential mixed methods design (adapted from Creswell & Creswell, 2018, p. 28)

This will enable the researcher to build on the understanding of the benefits and constraints of PBL in an NCEA context by using qualitative data to explain the quantitative data in more depth by integrating the data sets. Although it is more common for the quantitative data phase to be more dominant in an explanatory mixed methods design, in this study the qualitative phase is more dominant as it will add more depth of understanding to the study (Creswell & Creswell, 2018).

3.4. Case study methodology

A case study is a useful research method as it allows the researcher to build an in-depth, holistic understanding of phenomenon in an authentic setting (Huby, Robertson, Cresswell, Crowe, Avery, & Sheikh, 2011; Stake, 2006; Yin, 2014). It fits well with an interpretivist worldview, as a case study methodology acknowledges that many realities may exist within phenomena and collection of data from a variety of sources and perspectives can converge and be triangulated, developing a deeper contextual understanding of the phenomena (Yin, 2014). Stake's (2006) explanation of the instrumental case study is the best fit for this research. He describes the purpose of an instrumental case

study as one that uses a case to gain an in-depth understanding of a particular phenomenon that may go beyond the case to provide a broader understanding of the phenomena (Stake, 2006). The phenomenon of interest in this research is PBL and the case is how it can be implemented in an NCEA context, in a specific school. Stake (2006, p. 6) describes the phenomenon that is to be studied as a quintain that should be viewed as “a target, but not a bull’s eye.” To understand the quintain, the researcher may study some single cases and use these cases collectively, known as multiple case research, to gain a greater understanding of the quintain by looking at the similarities and differences about the cases, rather than the specifics of each individual case (Stake, 2006).

This research will use a multiple case study consisting of three cases, rather than a single case study approach, to ensure that the range of potential different practices that may exist in different schools, due to the flexible nature of NCEA assessment and course design, helps to build rich data that adds to the understanding of the quintain or phenomenon. By triangulating data through cross-checking information gained from a range of people between the schools in each case, conclusions may be drawn that take into account that variation in practices may occur when implementing PBL and this increases the internal validity of the research (Huby et al., 2011). Within the multiple case studies, the mixed methods design will be embedded and analysed within each case before comparisons are made between each case.

3.5. Case study selection

Due to the infrequent practice of PBL in the NCEA context, the selection of cases was made in the belief that they are replications that may help to generate similar themes in the analysis but also may elicit contrasting results or rival explanations (Yin, 2014). The case studies selected were all from full co-educational urban secondary schools, rather than senior high schools (only Year 11 to 13), in order to represent the context that is more common in New Zealand. Therefore, the understandings gained potentially have more practical applications in schools that wish to implement PBL in the NCEA context in the future. In order to gain permission to carry out research in schools, participation

forms were sent to the principals of the schools to obtain signed consent after ethics approval was granted (see Appendix A).

3.6. Data collection methods

Mixed methods research within a multiple case study framework offers the opportunity to gather data from a range of sources. Typically, case study researchers will use multiple sources of data providing multiple measures of the same phenomenon and use these measures to triangulate the data to confirm the findings and increase the validity of the research (Stake, 2006; Yin, 2014). Methods may include interviews, direct and participant observations, surveys using questionnaires, and document analysis (Yin, 2014). In this study Likert-type scale and open-ended questions within a questionnaire, semi-structured interviews and document analysis were the main sources of data collection. Participant observations were not used in the data collection as PBL occurs over extended periods of time, and data from short observation periods may not add valid understandings of PBL implementation.

a. Surveys using Questionnaires

Questionnaires administered via web tools, such as Survey Monkey, are popular in research as they are easy to conduct, have the potential to reach large groups of people, and gather larger amounts of data (Ary, Cheser Jacobs, Sorensen, & Walker, 2013). Questionnaires usually contain close-ended questions where relevant responses can be determined and some open-ended questions, when the researcher is not able to pre-determine the range of possible answers to a question, and the participant is able to respond freely (Ary et al., 2013; Johnson & Christensen, 2014). In this research open-ended questions were used, as well as Likert- type item questions. Likert-type item questions assessed participant attitudes towards PBL by their responds to the statements on a five point continuum from strongly disagree to strongly agree. An advantage in using Likert-type scales is that numbers can be assigned to the response categories giving ordinal data that can be used to calculate some statistical measures such as frequency, median and mode as well as correlations with other variables (Ary et al., 2013). Due to the response categories not being part of a linear continuous scale, it is not appropriate to

calculate the mean and standard deviation as a measure of central tendency (Ary et al., 2013).

The use of a questionnaire adds to the richness of the data collected about the participants' perceptions of the phenomenon, as it is administered in a cross-sectional manner at a given point in time. It allows the researcher to use the data from the questionnaire to purposefully sample individuals to interview in the next phase of the research (Creswell & Creswell, 2018).

In this study, cluster sampling, where a group of individuals are naturally together (Ary et al., 2013), was used to distribute a separate questionnaire via Survey Monkey to all the teachers in the case study school and to groups of students who were currently involved in PBL at the NCEA level. Both teacher and student questionnaires contained open and closed questions that collected data on demographics and perceptions towards PBL in the NCEA context (see Appendices B and C). The student questionnaire, given to the students who were currently taking part in PBL at the NCEA level in the case study schools, also had a second purpose. This was to gain data on the motivation of the learners who were engaging in PBL. The relevant questions for the motivation scale were from Pintrich's Motivated Strategies for Learning Questionnaire, commonly refered to as MSLQ (Pintrich, Smith, García, & McKeachie, 1991), and adapted for a PBL context. The questions used relate to the value component of goal orientation and task value, and the expectancy component of control of learning beliefs and self-efficacy for learning and performance. It is rated using a seven point Likert-type scale on a continuum from 1= not at all true of me to 7= very true of me. The MSLQ also has sections containing questions on test anxiety and learning strategies related to metacognition. These questions were not used as the data gathering was occurring early in the school year and the learning stategies that may be developed as the PBL continues through the year, may not be evident at the time of the data collection. However, the students' beliefs about their ability to succeed in a PBL environment and the values and goals they have about their learning, may have an impact on their perceptions about PBL. By gathering data on motivation levels, purposive sampling of students with high levels of motivation and

students with average to low levels of motivation were randomly selected for participation in focus group interviews, once consent was gained.

b. Semi-structured individual and focus group interviews

Interviews enable the researcher to understand, in greater depth, the views of others about their perceptions and experiences of phenomenon, so that the researcher can make meanings about the phenomenon through their analysis of the content of the interview (Josselson, 2013; Punch & Oancea, 2014).

Semi-structured interviews are useful in data collection as there are a sequence of themes that are explored by some prepared structured open-ended questions, but allows for flexibility to ask follow-up questions to probe and unpack important ideas that emerge from the interviewee answers (Kvale, 2007). Through semi-structured open-ended questioning, the researcher gains an in-depth insight into the interviewees' perceptions about the phenomenon. Semi-structured interviewing does require careful planning, such as organising the logistics of the interview and scripting open-ended questions, as well as some potential probing and clarifying questions, to maximise the effectiveness of the interview. (Huby et al., 2011; Kvale, 2007; Punch & Oancea, 2014).

Semi-structured focus group interviews, also using open-ended questions, are more complex for the researcher to manage than interviews with individuals. The researcher has a facilitator role, establishing rapport and guiding conversation by asking questions but allowing for discussions to occur within the group in response to those questions (Punch & Oancea, 2014). People management is important in group interviews so that the group interactions are balanced and participants have equal chance of contributing their thoughts (Punch & Oancea, 2014). Focus group interviews can be advantageous to researchers as the interaction between the participants potentially can reveal greater insights about the participants' perceptions than is the case with single researcher-participant interviews (Ary et al., 2013; Punch & Oancea, 2014). However, researchers need to be mindful of the potential for group dynamics to influence the views of individuals that are expressed (Ary et al., 2013).

In each case study school, through self-identification in the questionnaire, it was anticipated that teachers with current PBL experience would be interviewed

separately. Focus group interviews were used with students, rather than individual interviews, as they may be more comfortable in a group of peers when interviewed by an unknown researcher.

c. Document analysis

Documents such as unit plans, assessment tasks, and other policy documents are useful to gather as they help to triangulate data collected from other sources, such as semi-structured interviews (Yin, 2014). This may corroborate the data or may introduce new information that contradicts other sources of data, and therefore, prompting further investigation (Yin, 2014). In this study, documents relating to the study that were examined were PBL process outlines, information provided to whānau and students, project templates, and assessment rubrics.

3.7. Data Analysis Framework

In order to analyse data in mixed methods research, the data needs to be reviewed, reduced, and organised into formats that assists analysis of the data (Creswell & Creswell, 2018; Punch & Oancea, 2014). Both quantitative and qualitative data was obtained during this research in three different case studies. Data was analysed separately in each case before being merged in a cross-case analysis. Data within each case was merged in the second phase of the study.

a. Quantitative data

Quantitative data was analysed by calculating frequency distributions using excel spreadsheets to produce frequency tables and graphs regarding the frequency of demographic data and perceptions towards PBL in relation to sample size for both teachers and students (Punch & Oancea, 2014). Grouping of students based on their motivational rating, high or lower, was calculated by the percentage frequency of responses of Likert category five (often true) and over. The high motivation group was categorised as having nine out of eleven responses to the MSLQ questions or 82%, at Likert category five or above. The lower motivation students were categorised if their five and above response rate was less than 82%. This cut-off point was chosen as it ensured that the

students in the high motivation group had a high frequency of their responses in the ‘usually true of me’ (6) and ‘very true of me’ (7) Likert scale categories.

Frequency distributions were calculated between the variables of motivation groups compared to the students’ Likert scale responses to their enjoyment of PBL. An inferential statistics test was used to test the association between the different motivation groups and their enjoyment of PBL. The Mann-Whitney U test was used to determine whether there was a statistical significance at the $p < 0.05$ between the independent variables of motivation groups and enjoyment of PBL. This test was chosen as the data was nominal and ordinal and the distribution was non-parametric. The test looks for statistical significance in the difference between the ranked means of the two independent samples (Field, 2009). The test was run using SPSS software. The effect size determines the importance of the difference between the ranked means between the two motivational groups and their enjoyment of PBL and is calculated using Pearson’s correlation co-efficient r (Field, 2009). The effect sizes are categorised as small when $r = 0.1$, medium when $r = 0.3$ and large when $r = 0.5$ (Field, 2009).

b. Qualitative data

The interview data was recorded using a password protected phone and later transcribed and stored on a password protected laptop. The transcripts along with open questions from the questionnaires were coded and developed into themes for analysis. An inductive thematic approach was employed to code and develop the themes for each case study, which was conducted using Nvivo software. An example of coding and theme generation is given in Appendix L. An inductive approach refers to analysing the data to assign codes that have not been predetermined and allowing the themes to emerge through iterative refinement (Ary et al., 2013). Thematic analysis refers to the process whereby the researcher familiarises themselves with the data, generates the initial codes, searches for the themes, reviews the themes, refines and names the themes, and analyses them to produce a report on the findings (Braun & Clarke, 2006).

Documentation was examined relating to implementation structure of PBL in the case study school as well as templates used to scaffold the PBL process and assessment rubrics.

c. Merging data sets

In mixed methods research, the data sets can be merged at the interpretation stage once data transformation is completed and the data can be compared to determine patterns of relationship between the data sets (Greene, 2007). In each case study, a process of triangulation was used to develop and interpret the findings in order to gain a greater understanding of where the data converged or diverged, which assisted in the development and elaboration of the themes (Creswell & Creswell, 2018).

d. Cross-case analysis

The findings in each case study were then analysed to make cross-case assertions. Stake (2008) suggests that researchers choose one of three 'tracks' or approaches depending on whether the quintain or phenomenon needs to be considered in response to what is happening in each case, or what is common in all cases. Stake (2006) suggests that Track I is the preferred track as it emphasises the situationality of the cases, whereas Track II focuses on the merged findings rather than the situational factors in the cases, and Track III focuses on the conceptual factors derived from the cases. Track I was adopted by this study as it allows the researcher to make assertions that emphasise the situational factors in each case (Stake, 2006). Stake's (2006, p.51) worksheet 5A was adapted to analyse the importance of each theme in each case study. The importance of each theme was then compared across each case in order to interpret the findings (see Appendix M)

3.8. Ethical considerations

As mixed methods research, embedded in a multiple case study approach, involves collecting data from people about their personal experiences, it is essential that the researcher acts with integrity and develops a trust relationship with the participants to protect them and the schools involved from harm (Ary et al., 2013; Creswell & Creswell, 2018; Punch & Oancea, 2014).

In this research, consideration was given to gaining the appropriate informed consent from the school, teachers, students (and the parents if the students were under 16 years of age) involved, reinforcing that participation in the research was voluntary and they have the right to withdraw the consent at any time up until the analysis of the data. Information letters and consent forms were distributed that included information on respecting the right of the teachers and students to withdraw from the study, outlined the purpose of the study, assured confidentiality, and that participation was voluntary.

Participants cannot be identified in the findings of the study and the interview transcripts and questionnaires were not shared with anyone other than the researcher. Interviewee names were coded by assigning numbers or letters so that individual participants cannot be identified. The coded data and the original interview transcripts and questionnaires are kept separately. All signed consent forms are confidential and stored separately with the researcher's supervisor. Participants in the interviews were asked not to share information about the interview or the discussions that took place during the interview.

The researcher made genuine efforts to minimise harm to participants by minimising disruptions to normal teaching and learning within the school, respecting the participants' personal and cultural beliefs, checking with participants that their views had been accurately recorded by sharing the transcripts with them if they requested it, and only used the data collected for the purpose intended. Transcripts for the student focus group interview were not shared with the focus group participants to eliminate the possibility that the transcript would be shared with others outside the group, which would breach confidentiality. The researcher accurately reported on the multiple perspectives of the participants, without bias. The researcher intends that these findings benefit the wider teaching population's understanding of PBL in an NCEA context. A copy of the findings pertaining to the case study school was made available to that school if requested.

A full human ethics application was made to the Massey University Human Ethics Committee prior to contact with case study schools to gain permission for data collection. This was granted in December 2018 (see Appendix K).

3.9. Research rigour

Validity in research refers to how successfully the methods adopted, measure what it is designed to measure (Creswell & Creswell, 2018; Punch & Oancea, 2014). Efforts were made to construct questionnaires and semi-structured interview questions that would elicit responses pertinent to the research questions. Triangulation of both quantitative and qualitative data helps to ensure that valid inferences could be made. Internal validity was considered by the method of sample selection and the protocols utilised in the interviews. Interview techniques were considered to ensure that the interviewer bias did not affect participant response. External validity refers to the extent in which the findings can be generalised to the wider population (Ary et al., 2013). Although case study data may be very specific to a case, consideration for this aspect was made by carefully selecting case study schools that are more representative of full secondary schools in New Zealand. The data was triangulated, and cross-case analysis occurred that may help to enhance the trustworthiness of the findings in order for some generalisations to be made (Creswell & Creswell, 2018; Stake, 2006; Yin, 2014)

Reliability is related to the consistency of measurement or how dependable the data or findings are (Ary et al., 2013). Efforts to address reliability include ensuring that there was no ambiguity or bias in the questionnaire and interview questions, an audit trail was established to allow data to be easily accessed and reviewed, and frequent checking of the code definitions occurred to ensure there was no drift in the assigning of codes to the data (Creswell & Creswell, 2018; Yin, 2014).

Even though steps were taken to increase the reliability and validity of the questionnaire, there may still be some factors that may affect the findings due to non-respondents and the lack of ability of the researcher to control the motivation and honesty of the participant when responding to the questionnaire (Mentor, Elliot, Hulme, & Lowden, 2011).

3.10. Methods procedure

A sequential explanatory mixed methods design embedded into three case studies was used in this research.

Table 3.1 Phases of the sequential explanatory mixed methods design

PHASE	PROCEDURE	PRODUCT
1a.Quantitative data collection	• Whole school teacher Likert-like questionnaire with some open questions • Likert-like questionnaire of students involved in PBL in NCEA regarding PBL and selected Pintrich's MSLQ	• Numeric data relating to teacher perceptions about PBL • Numeric data relating to student attitudes about PBL and motivation • Open ended question responses
1b. Quantitative data data analysis	• Univariate data screening using Excel spreadsheets and graphing • Bivariate data screening using SPSS software • Open questions will be coded and inductively analysed and merged with qualitative data from the interviews	• Descriptive statistics for teacher and student attitudes towards PBL • MSQL ratings • Mann Whitney U statistical test to test for an association between student motivation scales and attitudes towards PBL • Themes from the open question will be collated and triangulated with the data from the interviews in phase 2
Connection Quantitative and Qualitative phases	• Purposive sampling selection of teachers based on current experience with PBL in an NCEA context • Purposive sampling selection of two focus groups of students based on MSQL ratings • Further refining of interview questions based on quantitative data	• 4-5 individual teachers in each case study school • Up to 5 students in each of the two focus groups in each case study school • Interview protocols and questions issued to participants prior to interviews
2a. QUALITATIVE data collection	• Interviews with 4 teachers using semi-structured interview questions • Interviews with two focus groups of students using semi-structured questions • Documentation relating to PBL analysis	• Text data – audio recordings transcribed of perceptions towards PBL and learning • Text record of cross-curricular PBL structure,learning objectives and assessment
2b. QUALITATIVE data analysis	• Coding and inductive analysis of interviews with teachers and student focus groups • Analysing information PBL to students and whānau, PBL process documents and templates, PBL assessment rubrics	• Cross-thematic analysis of interviews and focus groups • Document analysis • Triangulation of themes between teachers and students, and themes across case studies
Integration of quantitative and QUALITATIVE data	• Interpretation and explanations of the quantitative and qualitative results • Cross-case study analysis	• Discussion • Implications for PBL implemetation in an NCEA context • Future research

Although efforts were made to select case studies of schools that were of a similar decile rating, roll, modern learning environments and length of establishment, due to the limited choice available that had implemented PBL at

the NCEA level, some variations occurred (see Table 4.7). The data was collected in a visit by the researcher to each case study school over a three day period, between mid March to April, 2019.

a. Phase One

Teachers and students were invited to participate in a separate Likert-type questionnaire in this phase after appropriate consent was gained (see Appendices B and C). The researcher personally spoke to each group prior to the questionnaire being distributed to explain the purpose of the research, the rights of the participant, and the procedure of the data collection. Information explaining the purpose of research, assurances about confidentiality and consent procedures was also attached to the email sent to the teachers and students (see Appendices F and G). Consent was given by completing the questionnaire anonymously. An option was given to provide an email address and contact details if the respondent was giving permission to be interviewed in phase two. Students who were under 16 were given parental consent forms to return prior to completing the questionnaire (see Appendix J).

Survey Monkey was used to distribute the questionnaire to the teachers in the case study school.

Table 3.2 Teacher survey sample size

	Case Study 1 – School A	Case Study 2 – School B	Case Study 3 – School C
Potential number of teacher participants	Approximately 80	Approximately 40	Approximately 49
Actual number of teacher responders	27	13	25

Teachers were selected to be interviewed based on their current experience with PBL in the NCEA context by information given in the questionnaire but in reality most self-identified and volunteered to be interviewed after the introductory talk by the researcher.

In School A, the questionnaire was distributed to all the students in the Future Focus class, both Year 11's and 12's, provided they had parental consent if they were under 16. Year 11's were surveyed as well as Year 12's in School A,

due to the unique, collective nature of the Future Focus group. In School B and C only Year 12's were sampled to mitigate the anticipated difficulties with students under 16 returning parental consent forms but also, as they had more experience with NCEA, they may have more insights into PBL at the NCEA level. As potential difficulties were anticipated with students wanting to complete the questionnaire, a time was chosen where the largest number of Year 12 students congregated in a time slot and the researcher was able to personally explain the purpose of the study and the consent aspects prior to the students completing the questionnaire.

Table 3.3 Student survey sample

	Case study 1- School A	Case study 2- School B	Case study 3- School C
Number of student survey responses	Yr 11 - 10 Yr 12 - 6	Yr 12 - 49	Yr 12 - 32

Students were randomly selected for the focus group interviews based on their motivation ratings from the questionnaire if they gave permission to be interviewed.

Data analysis from this phase was analysed using excel spreadsheets after the visit was completed, but the open questions were scanned by the researcher during the visit to refine the semi-structured interview questions in phase two.

b. Phase Two

This phase involved semi-structured interviewing (see Appendices D and E). Consenting teachers in each case study school who were currently using PBL were interviewed for approximatley 30 to 40 minutes at a time convenient to them, in a quiet space. Teachers who were not involved in PBL were not selected as they may not have had the experience of PBL that would add to a greater understanding of the phenomenon.

Table 3.4 Teacher participants in the semi-structured interviews

	Case study 1- School A	Case study 2- School B	Case study 3- School C
Teachers participants in interviews	2 females 3 males	2 females 2 males	3 females 1 male

Interview protocols outlining confidentiality, consent to audio-record the interview, and logistics were given to the teachers participating in the interview and signed consent was gained before the interview started (Appendix H). The same interview structure and semi-structured questions were used with each participant to ensure uniformity, but flexibility was used regarding prompting and clarifying questions depending on the participant's responses. A password-protected phone was used to record, and later transcribe the interview. Teacher participants were given a copy of the transcript to ensure accuracy and edit, if requested.

The same procedure was used in the student focus group interviews (see Appendix I). Particular emphasis was made on the confidential nature of the interview. For this reason transcripts were not shared with the student participants. All students interviewed who were under 16 had parental consent (see Appendix J). It was anticipated that there would be four students in each focus group with a balance of gender and high and lower motivation levels. However, due to willingness, attendance, and other school events, there was some variation in the focus groups.

Table 3.5 Student focus group semi-structured interview participants

	Case study 1- School A	Case study 2- School B	Case study 3- School C
Focus group 1 participants	Yr 11's 3 Males =HM, LM, LM 2 Females =HM, HM	Yr 12"s 3 Males =HM, LM, LM 2 Females = HM, LM	Yr 12's 1 Male =LM 1Female =HM
Focus group 2 participants	Yr 12's 3 Males =HM, LM, LM, 2 Females =HM, HM	Yr 12's 3 Females = HM, HM, HM	Yr 12's 1 Male =HM 1 Female =LM

HM = High motivation, LM= Lower motivation

The interview transcripts were coded and inductively analysed to develop meta-themes using Nvivo software. This was triangulated with the phase one data and with the teacher and student perspectives about PBL. Open questions from the questionnaire and focus group interview data were used to interpret the findings for the different motivation groups in relation to their enjoyment of PBL. Documentation was analysed and triangulated with the qualitative data to gain further perspectives on how PBL was implemented in each case study. The

findings for each case study were then compared in a cross-case analysis to develop the findings.

3.11. Summary

This chapter has outlined the methodology that underpins this research and seeks to clarify the decision made to use a multiple case study approach embedded into an explanatory sequential mixed methods design. The chapter also outlined the data collection and analysis procedure and the steps taken to ensure that the research is trustworthy and ethically sound. The next chapter will outline the findings made based on the analysis of the data.

CHAPTER FOUR: Findings

4.1. Introduction:

The following chapter outlines the findings from both phases of the research. This includes the questionnaire data from phase one and the semi-structured interviews and relevant document analysis from phase two of the research for the three case study schools. All data was gathered between late March and the end of April 2019. All schools are located in urban areas in New Zealand. Each case study is presented separately, integrating the phase one and two data for that case. By presenting the case studies separately, a more comprehensive understanding is gained about the nuances of the individual school's project-based learning (PBL) programme in the NCEA context and the perceptions of the teachers and students relating to that context. This is followed by a cross-case analysis to highlight the important of the similarities and differences in the key emergent themes.

4.2. Case Study One: School A

a. Description of the school

School A is a Decile 6, Year 7 to 13, co-educational secondary school that was established within the last decade and has a modern learning environment. The roll has rapidly increased in the last few years to reach a total of approximately 1400 students. Other roll data is not given to protect the identity of the school.

b. Description of the implementation structure of PBL at the NCEA level, at School A:

i. Philosophy of the Future Focus programme

An aspect of the school's vision is to create lifelong learners who value relationships and the community. This involves the students actively determining their learning journey by doing, creating, and communicating through a process of inquiry. Aligned to this philosophy is the creation of a Future Focus programme at Year 11 and 12. The programme was created in 2018 at Year 11 and now, in 2019, has a total of 27 students who have elected

to be part of the programme; 19 males and 8 females of which 18 are Year 11 and 9 are Year 12.

The Future Focus programme offers the opportunity for learners in the senior school to have a significant personalised learning experience where they learn by using a self-driven project that they feel passionate about and is authentic, as it represents a problem to be solved in the wider community or has outcomes that have real world applications. Through engaging in the project, the school envisages that the students in the programme develop employability skills (teamwork, communication skills, resilience, positive attitude, thinking skills, self-management, and willingness to learn), alongside successfully completing NCEA credentialing.

ii. Structure of the Future Focus programme

The core approach for learning for both Year 11 and 12 students is their personal project. A series of 'taster' workshops are used to generate ideas for projects at the start of the year and then primary data is gained from stakeholders (external partners such as businesses or organisations) in the community. A design thinking process is used as a framework for the PBL process, which includes empathise, define, ideate, prototype, and test phases (Hasso Plattner Institute of Design at Stanford, nd). Gaps in student knowledge and stimulation for further learning is supplemented by some teacher-directed instruction. The school timetable is divided into three 100 minute blocks in a day, on a ten day cycle. Students have project learning time on rotation with six teachers who have expertise in English, Mathematics, Science, Technology, Social Sciences and PE/Health, for twenty-five blocks per cycle. Additionally, there are two blocks of physical activity as well as three blocks of mentoring time per cycle. Teachers mentor up to six students each depending on the teacher's expertise in relation to the student's project. Year 11 students can choose to join the mainstream classes for one additional subject, instead of a corresponding block in the Future Focus class. In Year 12 the programme alters slightly to accommodate three additional subjects, mainly due to the influence of University Entrance requirements in Year 13. Aside from additional

subjects chosen, most NCEA achievement standards are gained from their project. In Year 11, some additional external assessments are undertaken.

c. Teacher and student attitudes towards PBL in the NCEA context from the questionnaire data

Demographic data from all teacher respondents is shown in Figure 4.1.

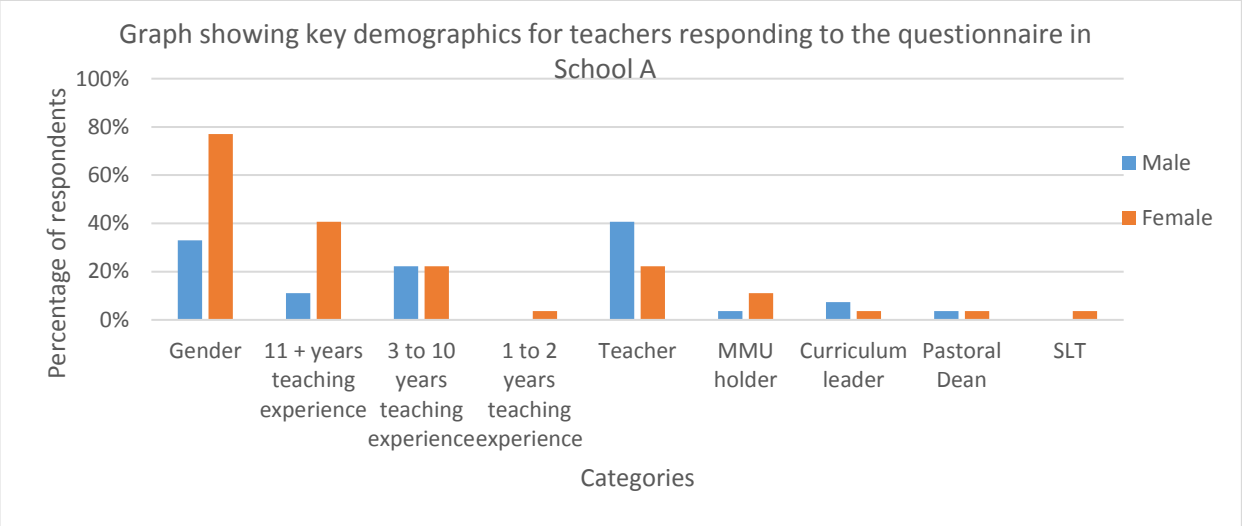

Figure 4.1 Graph showing key demographics for teachers in School A

i. Teacher attitudes towards PBL in the NCEA context

Teachers' responses to six questions on their attitudes towards PBL in the NCEA context are summarised in the table below.

Table 4.1 Percentage frequency of teacher responses to attitudes toward PBL in School A

Questions	Strongly disagree %	Disagree %	Agree nor disagree%	Agree %	Strongly agree %	Total
PBL is an effective teaching and learning strategy for engaging student interest and motivation.	0%	7%	22%	44%	26%	100%
PBL is an effective teaching and learning strategy for achieving targeted learning outcomes.	0%	11%	30%	41%	19%	100%
PBL is a learning strategy that should be used at NCEA levels.	7%	11%	30%	37%	15%	100%
PBL could be realistically implemented at NCEA levels.	4%	15%	22%	41%	19%	100%
PBL helps to develop the capabilities that students need to become life-long learners.	0%	0%	26%	44%	30%	100%
PBL is less effective if implemented in a cross-curricular manner than in single subject domains	7%	26%	37%	19%	11%	100%

Although there are 70%, 60%, and 74% respectively of respondents who agree or strongly agree that PBL is an effective learning strategy for engaging student interest, achieving targeted learning outcomes and developing life-long learners, only 52% of respondents agree or strongly agree that PBL is a learning strategy that should be used at NCEA levels. A slightly higher percentage (60%) thought that PBL could be could be realistically implemented at the NCEA level.

These responses from two teacher respondents, not teaching in the Future Focus programme, who disagreed or strongly disagreed, typifies some of the concerns:

"Students who lack self-discipline and management would become lost." Survey Teacher 1

"Ensuring students complete the required standards." Survey Teacher 21

Teacher responses are quite evenly spread regarding whether PBL is less effective when implemented in a cross-curricular manner (as in the Future Focus programme) compared to a single subject domain, with 33% who disagree or strongly disagree with this, 30% who agree or strongly agree and 37% who neither agree nor disagree.

ii. Student attitudes

Demographics

Only students who were in the Future Focus class were surveyed or interviewed. Responders were ten Year 11's and six year 12's, with a total of nine males and seven females.

Summary of attitudes towards PBL in the NCEA context

Student responses to three questions relating to their attitudes towards PBL at the NCEA level are summarised in the following graph.

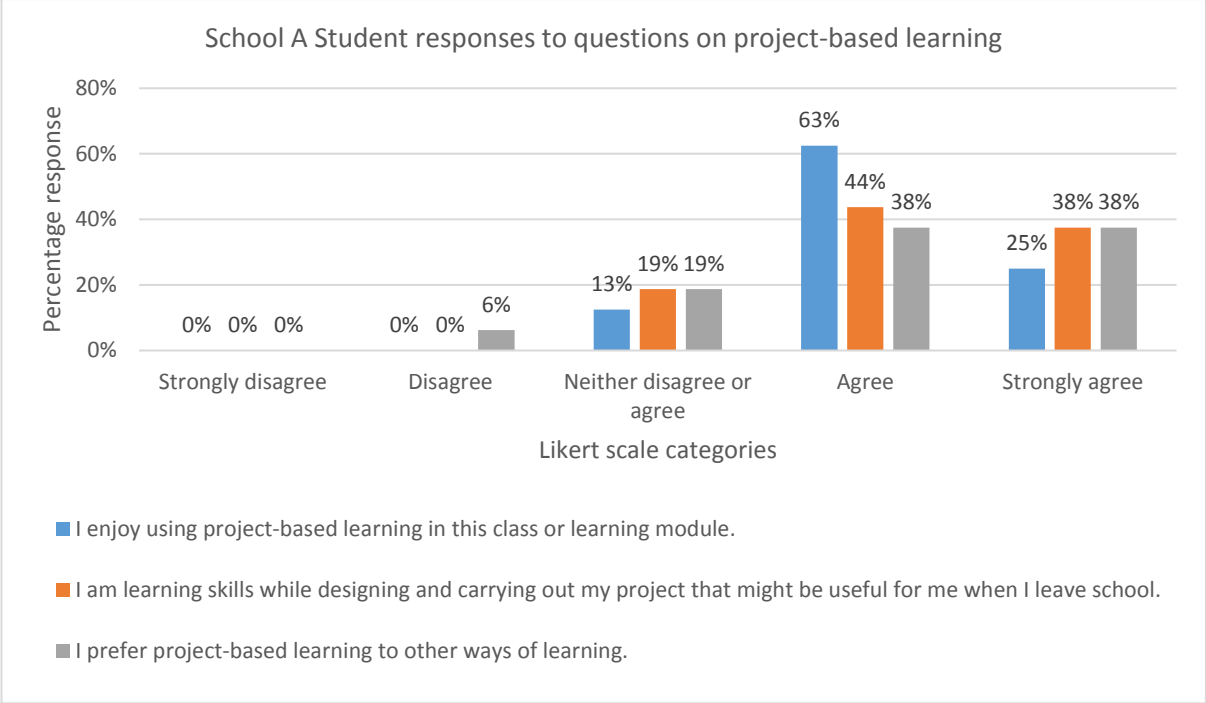

Figure 4.2 Graph showing frequency of student responses to attitudes towards PBL in School A

Students responding to the questionnaire enjoy using PBL in their Future Focus class with 88% of students either agreeing or strongly agreeing with this statement and 13 % who are more ambivalent towards the strategy. 82 % of students feel that the skills they are learning are worthwhile. 76% prefer using PBL as a learning approach compared to other ways of learning. Of the three students who make up the 9% who neither agree nor disagree, two of these students are at Year 11 and one is at Year 12. The one student who disagrees with the statement is from Year 11. It could be hypothesised that this may be due to Year 11's being less confident in the PBL process at this early stage of the year.

Student motivation scales and attitudes towards PBL in the NCEA context

A modified version of Pintrich's MSLQ motivation questionnaire was used primarily to sort students into high motivation and lower motivation groups for

the focus group interviews in order to see if there is differences in perspectives between the two groups.

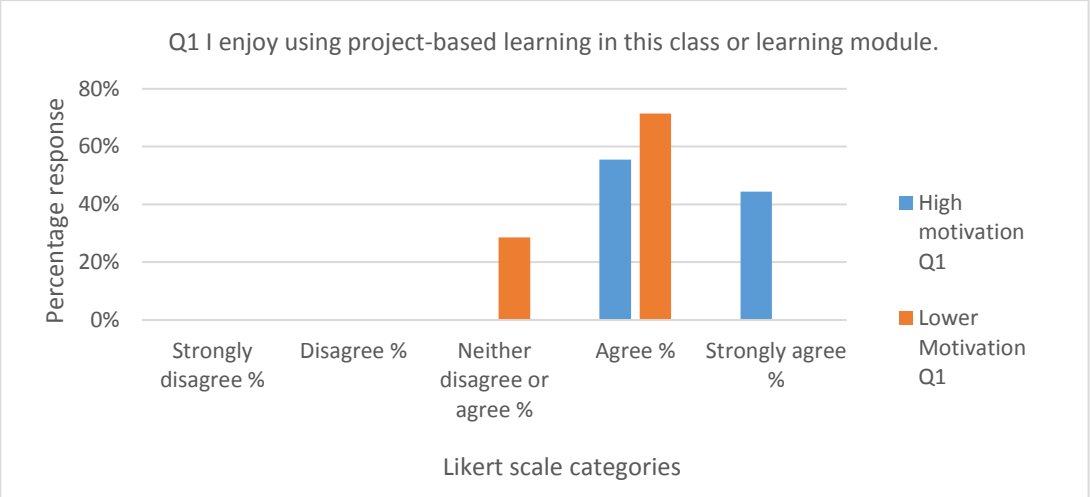

Figure 4.3 Graph showing the percentage differences in responses from students in the high motivation group compared to the lower motivational group

Due to the non-parametric nature of the data and the small sample size, the Mann Whitney U test was applied to see if there was a statistical significance between the ranked mean of the two motivation groups for Question 1.

Table 4.2 SPSS Mann-Whitney U results

Test Statistics[a]

	Likert_responses_Q1
Mann-Whitney U	12.500
Wilcoxon W	40.500
Z	-2.336
Asymp. Sig. (2-tailed)	.019
Exact Sig. [2*(1-tailed Sig.)]	.042[b]

a. Grouping Variable: Motivation_level

b. Not corrected for ties.

The level of significance (2 tailed) is 0.019 which is statistically significant at the 0.05 level, showing there is a statistical significance between the motivational groups and their enjoyment of PBL in the NCEA context, U =12.5, z=-2.336, p< 0.019, r= -0.58. There is a large effect size which indicates there is a large

difference between the ranked means of the two motivation groups, with the high motivation group having a higher ranked mean for enjoyment of PBL.

Data shows that the differences in attitudes towards PBL in the NCEA context may be due to the students' perceptions about their ability to self-regulate, especially in relation to time management, perseverance, and sense of self-efficacy towards achievement of goals.

Students in the lower motivational group articulated challenges with PBL such as managing themselves and persevering with their project work.

"Other people distracting me from my work. Some days I just don't feel like doing work." Year 11 Survey Student 9

"*Working individually and only getting a little help from the teachers once in a while."* Year 11 Survey Student 5

"One of the biggest ones is probably self-management, managing yourself and getting everything in on time. I think it is easy to drift away from your topic and start mucking around." Year 11 Interview Student A

Students in the high motivation group tended to be more optimistic that they were able to deal with challenges successfully and develop the resilience and determination to persevere with their learning.

"I think in Future Focus you need certain skills to be able to complete and carry out a project but having said that it also gives you the opportunity to learn those skills." Year 11 Interview Student C

"I found that in Future Focus doing the work the way we do, I just feel I have learnt from it a lot more than in the past 12 years of learning." Year 12 Interview Student D

d. Key themes emerging from the teacher and student interviews and open questions from the questionnaire data

i. Enablers of effective enactment of PBL in the NCEA context

The highest frequency of responses from teachers (26) is that PBL is student-centred and student-driven learning, and it focuses on the interest or passion of the learner.

"I think the big one is student choice, the students have to have something they are passionate about otherwise the thing just doesn't fly." Future Focus Teacher Interview A

Students also made frequent references to these characteristics.

"Being able to learn through something that you love provides you with skills that you are going to need for the future that you will remember." Year 11 Student Interview C

The next most frequent PBL characteristic for teachers was that projects need to be developed to solve a problem or have an impact in the community. Students, therefore, need to establish links with a stakeholder in the community. This allows authentic learning with real world applications (seven responses) and development of problem solving skills (four responses) as the project attempts to solve stakeholder issues at a practical level. Also important is a design thinking framework (five responses) for students to follow and accountability mechanisms, which in part arise from the involvement of the stakeholders. Most NCEA assessment standards should arise naturally from the project, rather than being the focus of it.

"There will obviously be sometimes where out-lying achievement standards don't fit but generally if you actually think about it really well and structure it properly, they should have the majority of the achievement standards falling out of that particular project." Future Focus Teacher Interview B

The projects also require assessment rubrics to guide students through the design thinking process but the end point or outcome is not necessarily assessed.

Another theme relates to the essential role the teacher plays in PBL. Teachers felt strongly (16 responses) that their role was one of a facilitator or guide who used coaching and mentoring to assist students with their learning, and manage and monitor their progress in a personalised manner.

"Most of your day is conferencing students, asking them questions and getting them to come up with solutions to issues that they have so they can move ahead." Future Focus Teacher Interview A

Students had similar perceptions regarding the role of the teacher. In particular, that they have a positive attitude towards PBL and the students' projects. Students enjoyed the collaborative nature of the relationships with teachers in Future Focus.

"The teachers in Future Focus are like more than teachers… with the Future Focus it is more like a co-worker relationship." Year 12 Interview Student B

ii. Benefits of PBL to the learner

The highest frequency of responses occurred with the sub-themes of increased engagement or motivation of students towards learning (20 responses) through personalised learning and choice (seven responses), development of the employability skills (13 responses) in authentic contexts (14 responses), deeper learning (seven responses), and development of student agency and self-management skills (nine responses).

"They get to investigate things that are important to them…., so that learning is deeper for them because it is meaningful learning, rather than teacher driven learning which is not necessarily meaningful." Future Focus Teacher Interview E

"Seeing the students develop …..by the end of the year they are completely self-contained and self-managing, resilient, and can problem solve." Future Focus Teacher Interview A

The focus on learning as opposed to NCEA credentialing was also considered as beneficial for the students. The NCEA credits they do gain reduces workload due to using the same work for multiple purposes.

Other benefits included the development of communication and collaboration skills by interacting with stakeholders in the community.

Student responses to the perceived benefits were most frequent in the personalised learning and choice (23), increased engagement (16), developing of employability or 21st century skills (10), and authentic learning (10).

"It allows you to learn what you want to learn and how you want to learn it." Year 11 Survey Student 16

iii. Barriers to student success using PBL

The most frequent sub-theme (12 responses) from teachers was that the level of self-management skills affected student success, although this was considered a skill that would develop as the year progressed.

Students also commented on this sub-theme most frequently (22 responses) and reflected that the lack of self-management, managing the work load and maintaining motivation could be barriers to their success.

"I personally find it harder to do many things though, because it requires me to essentially organise everything myself." Year 12 Survey Student 11

Other barriers related to scoping the project initially, lack of access to specialised learning spaces and to expert teachers outside of the Future Focus programme that could help with the students' projects. Difficulties with the availability and communicating with stakeholders was also identified.

"So there might be a student who has chosen something to do with programming but they don't really have access to that, they are not enrolled in that." Future Focus Teacher Interview E

Students described how they found it difficult to make initial contact with the stakeholders and some found teachers outside the Future Focus programme to be unavailable or not willing to help.

"The biggest challenge is seeking knowledge from outside the school. It is scary to be a school kid talking to adults who are unfamiliar about our projects." Year 11 Survey Student 7

"I've had a teacher come up to me and they said, "Oh, that is not going to work, you are going to fail in that." Some teachers don't believe in this." Year 11 Interview Student C

Some teachers outside of the Future Focus programme thought that PBL is better placed inside siloed curriculum areas so that curriculum coverage was not compromised.

The students believed that the teachers needed to communicate more, especially about the project templates that were used, which was a sub-theme that teachers also identified. Teachers perceived there was inadequate communication and team teaching time. Although most Year 12's enjoyed the three subjects they chose from the mainstream curriculum, they found there were competing demands to cover other curriculum content and time out of the Future Focus class meant missing contact with the teachers in the programme.

Students felt anxious about the demands placed on them to gain NCEA credits, especially in Year 11. It is possible that they were yet to be convinced that the credits would naturally fall out of their projects compared with their peers at school in the mainstream classes.

"You have to push through that feeling of uncertainty before going yup I can *do NCEA through this."* Year 11 Interview Student C

iv. Challenges or barriers to implementation of PBL

The most frequent sub-theme (36 responses), was the impact of the NCEA and the University Entrance (UE) imperative. Teachers find that the structure of NCEA is limiting the full potential of the Future Focus programme, particularly with the prescriptive nature of the NCEA assessments, the lack of understanding of standards outside the teacher's area of expertise, the number of credits required for each level and UE, and the lack of recognition of the employability or 'soft' skills. This is the main reason why Year 12 students take three subjects outside of the Future Focus programme.

"*The only thing that is still probably holding things back at the moment is the fact that ultimately NCEA is very prescriptive and they have to have set things that don't always fit with the project or a particular student's project."* Future Focus Teacher Interview B

Whānau anxiety about NCEA credentialing also impacts on the Future Focus programme numbers.

"The issue I think is convincing parents, as much as anything, that it is a valid way of learning. A lot of them think it is a great idea but they are always nervous about NCEA." Future Focus Teacher Interview A

Another large sub-theme was the structural impact of the school environment. This included large class sizes, the siloed curriculum approach in the rest of the senior school, timetabling issues and the lack of access to specialist areas, workload issues for staff and staff resourcing, and managing students offsite.

" …we are trying to shoe horn something in that is different to fit it into an existing system that doesn't really accommodate it." Future Focus Teacher Interview E

Teacher capability with PBL was another issue. Teachers articulated that there was a lack of New Zealand based professional learning around cross-curricular PBL and how it is applied in the Future Focus context. Most of the understanding about the PBL process has been self-generated. Key professional learning requirements identified include how to effectively track and monitor students and ensure accountability. They also identified that other teachers in the school needed to better understand what PBL is in order to get

more ‘buy-in’. Different philosophies existed regarding how best to prepare their students for NCEA and feelings that Future Focus might not suit all students.

v. Future development of PBL in Future Focus

Teachers expressed that PBL specific NCEA credits, that acknowledged the employability and project specific skills, were needed. This would alleviate some of the anxiety about gaining sufficient NCEA credits and would make it easier to align the standard to the variations in projects.

The students interviewed strongly articulated how useful it would be to have project specific NCEA standards that were also recognised as UE.

“That would be a complete game changer and I think if those credits are recognised by university as UE…” Interview Student B

“A lot more people would probably want to do Future Focus if they allowed that.” Year 12 Interview Student D

Teachers also suggested various structural changes in the school that would make it easier to communicate with each other and provide the subject specific expertise on an as-need basis.

“Ideally what we would like to have is a project-based learning Commons where teachers are in there all the time ….having four or five teachers in a Commons with 120 kids would be the goal.” Future Focus Teacher Interview C

More flexible timetabling was also suggested, so that students were able to access specialist staff and spaces as needed in their projects.

4.3. Case Study Two: School B

a. Description of the school

School B is an integrated Decile 6, Year 7 to 13, Catholic co-educational secondary school. It is in the final stages of a rebuild which offers more flexibility in how learning spaces are used. The roll in March 2019 is approximately 500. Other roll data is not given to protect the identity of the school.

b. Description of the implementation structure of PBL at the NCEA level, at School B:

i. Philosophy of the Impact Project programme

All students are involved in Impact Projects at School B. The emphasis of Impact Projects is that they must make a contribution to someone beyond themselves, so students are encouraged to look at the wider community in order to address issues, problems, or needs. This also aligns with one of the Catholic principles in the school's graduate profile which is to develop community-minded graduates who are able to show leadership through service to others and promote stewardship of the Earth and social justice. The school explains that projects are important for students to engage in as it develops 21st century skills and student agency in a meaningful, authentic context, as well as developing resilient, self-managing and independent learners. It also gives senior students the opportunity to link their projects in a meaningful way to gain NCEA credits.

ii. Structure of the Impact Project programme

School B has implemented PBL through Impact Projects throughout the year levels since 2016 and has refined the process over time. In 2019, students can choose a project under one of nine umbrella themes. The three key focus umbrellas are Care for Others, Stewardship of the Earth, and Build My Own project. The six other umbrella options are Performing Arts, Sports, STEM, Careers, Trades and Design, and Art. There is a further division in that some projects, particularly the Build My Own project, are teacher-facilitated projects where the students take ownership of the project. Other umbrella projects are teacher-directed where the teacher initially sets the direction of the project. Duration of projects ranges from one semester (14 weeks) to a full year. Project groupings potentially consist of students from Year 7 to 13. The school has three 100 minute blocks of timetabled classes per day. Impact Projects are assigned one block on Wednesday and two blocks on Friday, per semester.

The framework for the projects has four key stages: proposal, progressing the plan, presentation, and evaluation. The scaffolding for the progression of the plan is dependent on the teachers in the umbrellas projects, although the

teachers in the Build My Own projects have developed their own inquiry framework. Students are encouraged to communicate and seek mentorship from community stakeholders.

An assessment rubric shared with the students at the beginning of the project is used as a self-assessment tool and for grading purposes. The rubric assesses competencies in student ownership and agency, substantial learning beyond the classroom, a quality product, and impact in the community. Project assessment grades are partly linked to the gaining of a 'Gold card' which gives off-site privileges for senior students.

NCEA standards are aligned with the student's project, although some teacher-directed umbrella projects have standards that can be assigned to all projects.

c. Teacher and student attitudes towards PBL in the NCEA context from the questionnaire data:

Demographic data from participants who responded to the questionnaire is shown in Figure 4.4

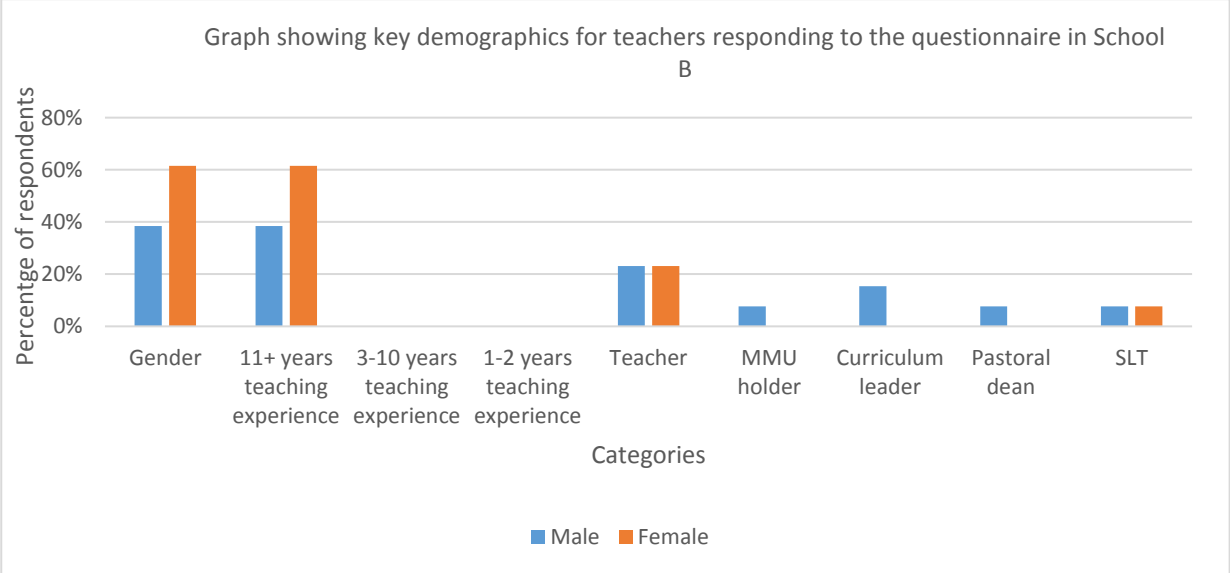

Figure 4.4 Graph showing key teacher demographics in School B

i. Teacher attitudes towards PBL in the NCEA context

There was low rate of return from the teachers for the survey with only 13 responses. The teachers' responses to six questions on their attitudes towards PBL in the NCEA context are summarised in the following chart.

Table 4.3 Percentage frequency of teacher responses to attitudes toward PBL in School B

Questions	Strongly disagree %	Disagree %	Neither agree nor disagree %	Agree %	Strongly agree %	Total %
Project-based Learning is an effective teaching and learning strategy for engaging student interest and motivation.	0%	15%	38%	23%	23%	100%
Project-based Learning is an effective teaching and learning strategy for achieving targeted learning outcomes.	0%	23%	8%	54%	15%	100%
Project-based Learning is a learning strategy that should be used at NCEA levels.	8%	8%	46%	15%	23%	100%
Project based Learning could be realistically implemented at NCEA levels.	0%	0%	31%	54%	15%	100%
Project-based Learning helps to develop the capabilities that students need to become life-long learners.	0%	8%	15%	46%	31%	100%
Project-based Learning is less effective if implemented in a cross-curricular manner than in single subject domains	15%	38%	15%	31%	0%	100%

In the survey, 46% of respondents agree or strongly agree that PBL is an effective strategy for engaging student interest, whilst 69% agree or strongly agree that PBL was an effective teaching and learning strategy for achieving targeted outcomes. No respondents strongly disagreed with these statements although 15% and 23% disagreed with the respective statements. Only 8% of respondents felt that PBL does not help students to develop the capacities to become lifelong learners. This same respondent also disagreed in the previous questions discussed. This respondent's concerns relate to the belief that teacher knowledge was needed to drive the learning. No respondents, however, thought that PBL could not be realistically implemented at the NCEA level, although 16% (which equates to two people) disagreed or strongly disagreed that PBL is a learning strategy that should be used at the NCEA level. Concern regarding covering enough content to ensure that students could progress to the next level and setting up projects so they could be realistically assessed against NCEA standards, formed some of their concerns.

53% of respondents believe that PBL is effective if implemented in a cross curricular manner, whereas 31% agree that PBL was more effective in single subject domains.

ii. Student attitudes

Demographics

49 Year 12 students responded to the questionnaire; 25 males and 24 females

Summary of attitudes towards PBL in the NCEA context

Student responses to three questions relating to their attitudes towards PBL at the NCEA level are summarised in the graph below.

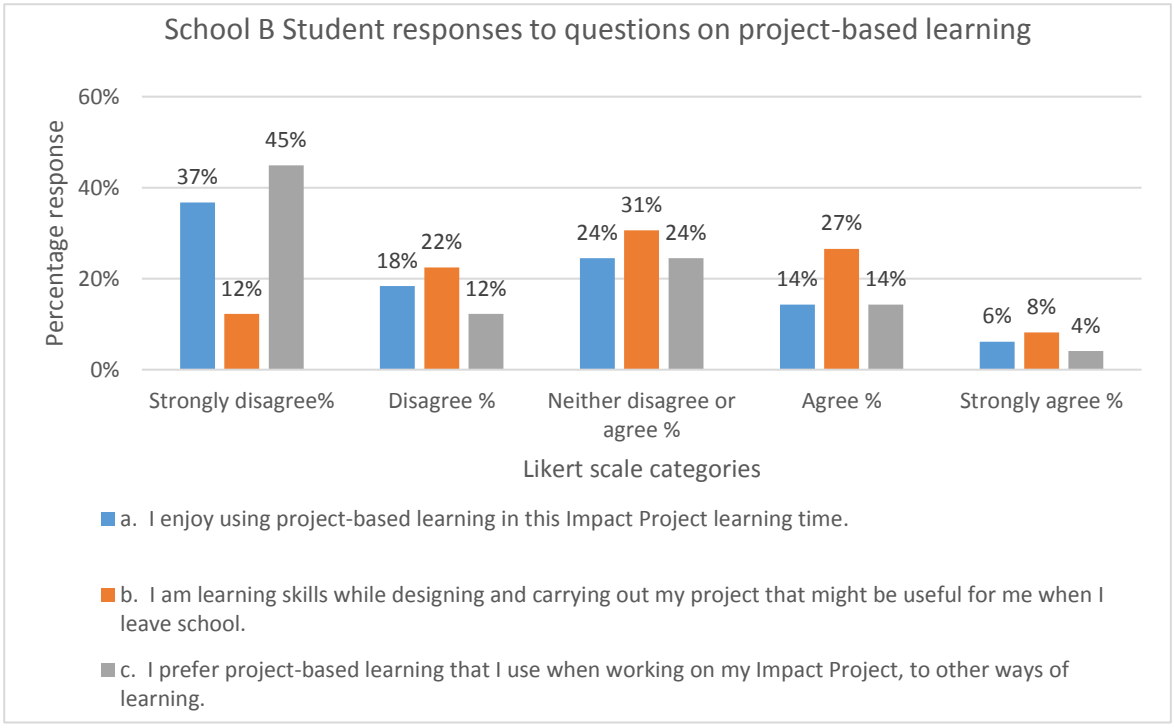

Figure 4.5 Graph showing frequency of student responses to attitudes towards PBL in School **B**

There is a greater proportion of students in School B who do not enjoy PBL, compared to 20% of students who agree or strongly agree that they enjoy using PBL in the Impact Project learning time. A similar pattern is observed with only 18% preferring PBL to other ways of learning. However in contrast, more students see the value in the skills they are learning using PBL with a similar percentage of 33% of students disagreeing or strongly disagreeing and 35% of students agreeing or strongly agreeing with that statement. Students who did not enjoy PBL and preferred others ways of learning but still see the value in the skills that are learning using PBL, perceive that the time spent on projects is taking away from other NCEA subjects and they feel uncomfortable with less teacher-directed learning.

"We have to self-manage and come up with what we are doing on those days ourselves. Impact projects also take time away from other classes making it harder to catch up." Survey Student 14

Student motivation scales and attitudes towards PBL in the NCEA context.

Motivational factors had a large influence on enjoyment and preferences for PBL learning with 76% of students in the lower motivational grouping who did not enjoy PBL learning compared to 25% in the high motivation group.

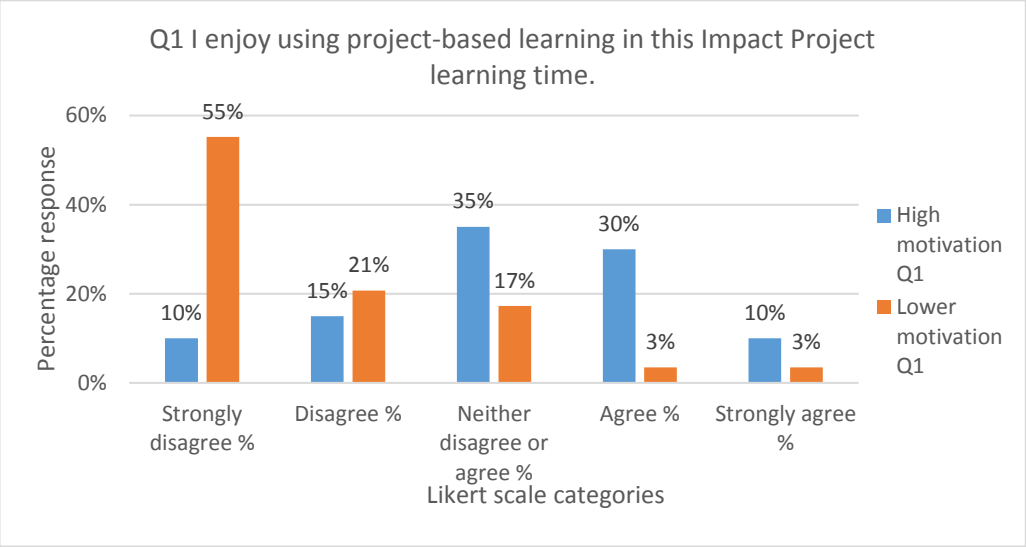

Figure 4.6 Graph showing the percentage differences in responses from students in the high motivation group compared to the lower motivational group

The Mann Whitney U test was applied to the data to look for statistical significance in the observed trend.

Table 4.4 Mann Whitney U results.

Test Statistics[a]

	Likert_response_Q1
Mann-Whitney U	113.500
Wilcoxon W	548.500
Z	-3.729
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Motivation_Levels

The level of significance (2 tailed) is 0.000 which is statistically significant at the 0.01 level showing there is a statistical significance between the motivational groups and their enjoyment of PBL in the NCEA context, U =113.5, z=-3.729, p< 0.000, r= -0.53. The effect size is large which indicates there is a large difference in the ranked means between the two groups.

The statistically significant differences in attitudes towards PBL between the two motivation groups stem from recurring themes regarding the value of PBL and the level of consistency in the grading of the projects as well as what is regarded as an acceptable level of project impact. Their self-efficacy beliefs about ability to self-manage also is a factor.

The lower motivation group more often do not see the value in PBL and perceive that the traditional subjects, with the associated NCEA credits, will benefit them in their future aspirations compared to the skills they learn in their Impact Projects. They also have grievances regarding how teachers grade their projects and permit them to do projects based on the level of impact it might have in the community. These students also often perceive that they are unable to self-manage without teacher direction.

"*…you get distracted and drift off and go and do other stuff because of the teachers not there saying you can't do that."* Interview Student A

"It's just not very stimulating because I'm zoning out most of the time." Interview Student E

"The marking system here at (school removed) *is inconsistent."* Survey Student 1

"The impact HAS to be on the community. For some reason I can't get away with doing something only for myself." Interview Student B

"Because we aren't for the projects we don't really try because we know we will get nothing for it so a lot of seniors will use the project time to do other subject internals and study because we know that those will benefit us..." Survey Student 13

In comparison the students in the high motivation group, while still sharing some of the concerns about the inconsistencies regarding the level of impact on the community a project needs to have and the grading of the projects, do see value in the skills they are developing while engaging in their Impact Projects.

"Kind of like ownership because it's mostly on you and not on the teacher for what you're doing." Interview Student D

"If you have a genuine passion in the project you are doing, it can motivate you to take your learning to a higher level. It can have an impact on the wider community. It develops independent learning more than other classes." Survey Student 10

d. Key themes emerging from the teacher and student interviews and open questions from the questionnaire data

i. Enablers of effective enactment of PBL in the NCEA context

The most frequent response (13) in this theme was that PBL is student-centred and student-driven learning which focuses on the passion and interest of the learner. Teachers perceived that students were more motivated to engage in their learning if they had the choice to follow their interests in an authentic context and had autonomy in the direction of their learning.

"Project based learning provides authentic rich learning for all students, enabling students to co-construct their learning while focussed on an area that interests them, increasing engagement and cognitive thought." Survey Teacher 3

Teachers also believe that the Impact Project needs to have an impact on the wider community. The skills learnt are applied authentically and it also develops citizenship in the students.

"…. looks outside of themselves, outside of the school and into the community and see what's in the community and what needs to be done and see if they can help." Interview Teacher C

The most frequent student responses (34) described Impact Projects as chosen and driven by the student and it was an issue in the community they felt passionate about.

"It has to be something that you would really like to learn about or an impact that you really would like to make because you see a problem." Interview Student C

Teachers mainly perceive their role as one of facilitation and scaffolded assistance in managing students with their projects and tracking progress. Some teachers also felt the project themes that they were involved in were more effective if their expertise was being utilised.

"This year has been the best project year for me because I feel like I am used more effectively for my background…" Interview Teacher B

The students also most frequently described the teachers' role as one of facilitation and providing guidance to the student without being biased towards particular projects and areas of impact in the community. There was variation in perceptions regarding the level of support and teacher influence that was acceptable in terms of deciding the direction of the project. Much of the dissention centred around the definition of what constituted an acceptable level of impact on the community. The students mentioned frequently that they needed to self-manage but often shifted the ultimate responsibility for tracking and moving projects forward, to the teacher.

ii. Benefits of PBL to the learner

The teachers' most frequent response was that projects gave students opportunities to develop 21st century skills, such as communication and collaboration, problem solving, resilience, perseverance and showing initiative. Common sub-themes also included the opportunity to engage with authentic learning, be able to relate to real life contexts and make links with their community. The teachers perceived this helped to increase engagement and deeper learning whilst developing agency and self-management abilities.

"Real life learning. Dealing with 'wicked' problems. Deeper learning, an opportunity to link with industry. Life-long soft skills developed to help students in all aspects of life." Survey Teacher 9

Teachers also indicated that although the project was the important aspect, students were able to gain contextualised NCEA standards. They felt that credits should fall out of the projects rather than developing the project to focus on the standards.

Students concurred with the teachers (26 responses) that PBL increased motivation and engagement by having personalised learning and choice (33 responses) and the opportunity to develop self-management skills (26 responses). The next most common sub-theme was developing 21st century skills such as co-operating in a team, communicating with the wider community, developing creativity and other skills such as leadership, perseverance, and intuition. Students also saw the benefit in having the opportunity to have learning experiences which they might not normally be exposed.

"The world is changing outside of school … a lot of employers want people who can think and so they want them to have better time management skills, thinking on the spot and those types of skills and with Impact Projects that really does help…" Interview Student A

iii. Barriers to student success using PBL

The most frequent barrier from the teachers' perspective is the student's ability to self-manage. It is partly due to this concern that teacher-directed umbrella projects were developed to provide more direction for some students.

"There was a massive percentage of them that just went sweet as, I got to do whatever I wanted to do for while …that's when we started to move on to more teacher-directed projects or umbrella projects." Interview Teacher A

Other sub-themes included the senior students' resistance to engaging fully with Impact Projects due to the value that is placed on other NCEA subjects, which they perceive as more important for gaining credentialing pathways to higher education.

"The Level 2 or 3 age bracket being the most resistant to projects in the school coming through because they are used to a traditional system." Interview Teacher B

Project fatigue was another sub-theme as well as dissension within staff and students regarding the level of impact on the community that a project was expected to make.

"So how much impact does it have to have on the community?" Interview Teacher D

Students also perceived that a lack of self-management skills contributed to poor outcomes in their Impact Projects (25 responses).

"It is a lot more work …..unless you have a really good strong project, good teacher, the mind-set to pull it off and good work ethic you probably won't learn anything." Survey Student 23

However, many of the responses (38) relating to barriers to their success using PBL centred around the effect of teachers vetoing their projects due to inconsistent understandings about what constituted a sufficient impact on the community. They also perceived this had an effect on the grade they received for the project which had ramifications on privileges such as earning a 'Gold Card'. This aspect seemed to be one of the important reason why some senior students did not enjoy Impact Projects.

"It's completely subjective, teachers have control over projects that you can and can't do depending on the teacher that you have….. if the teacher doesn't think it's got a big enough impact, because it has to be on the community it can't be on yourself, …" Interview Student C

Another large barrier which decreased enjoyment of Impact Projects (40 responses) is the value that students place on PBL. With a project running over three timetabled blocks they perceived it took up time from other subjects. This related to the value that the students placed on NCEA credits from traditional subjects over the skills that they might gain from engaging in a project. Some students perceived that teacher-directed learning would help them to achieve NCEA credits more easily.

"There are no benefits for me because as a year 12 student my main concerns are passing my internals and externals. By spending an entire day on Impact Projects I am losing valuable time…." Survey Student 20

"The focus on student learning. Teachers get paid to teach and that isn't what they are doing. It's why they're called teachers." Survey Student 8

Inconsistencies with the project frameworks, such as the templates used, were also mentioned as well as the volume of paperwork that was required to get a good grade for the project.

"…any meaningful impact is overshadowed by a towering stack of paperwork." Survey Student 2

iv. Challenges or barriers to implementation of PBL

Teachers perceived the main barriers to implementation related to the lack of consistent expectations regarding project impact, the level of scaffolding, and assessment of projects. This was compounded by a lack of shared philosophy regarding the value of PBL in the NCEA context. There were differences of opinions relating to how well NCEA standards could be aligned to projects and the value of cross-curricular projects as opposed to the subject specific learning in siloed subjects. The self-directed nature of PBL means that project teachers could be dealing with a range of disciplines within an umbrella group and some teachers felt ill equipped in knowing the range of NCEA standard requirements that were outside their area of expertise. Some subject specialists felt undervalued or forced into areas in which they had no interest.

Other implementation challenges included structural issues, such as student access to specialist teachers for their projects, workload issues for staff, and not all teachers being involved in projects. This affected teacher buy-in as not all teachers were having the same experience or vision. An absence of recent professional learning was also attributed to a lack of buy-in or understanding about the value of PBL with some teachers. Visits to other PBL schools by teachers and students was suggested.

Engaging whānau was seen as another challenge, especially relating to how to change attitudes regarding the value of projects in developing key competencies and 21st century skills, as opposed to credit accumulation.

"Everyone sends their kids here because they think we are an established traditional Catholic school …and then we make this shift through and it's at this point it is noticed, oh it's not quite as traditional as I thought." Interview Teacher C

v. Future development of Impact Projects

At the NCEA level, teachers suggested a continuum of ideas from incorporating PBL into siloed subjects to having all cross-curricular learning modules being PBL (although it was acknowledged that might be a step too far at present).

Teachers thought that the development of some generic project specific NCEA standards, similar to the rubric that school currently uses for assessing projects, would be desirable.

"I want a standard which could be made up of three minor standards, but I want a standard that is at least 14 credits: planning, the process, collecting evidence, the result, it would be a bit like the rubric but it would be a project standard." Interview Teacher C

4.4. Case Study Three: School C

a. Description of the school

School C is a decile 10, Year 9 to 13, co-educational secondary school. The roll in April 2019 is approximately 600 students. The school was established within the last decade and has a modern learning environment. Other roll data is not given to protect the identity of the school.

b. Description of the implementation structure of PBL at the NCEA level, at School C:

i. Philosophy of the Impact Project programme.

The school's vision is made explicit on the front page of their website with the words Innovate, Engage and Inspire and it strives to create a learning environment where innovative, personalised learning through inquiry is at the essence of the learning experience. As part of this experience, all students engage in PBL explicitly through cross-curricular Big Projects at Year 9 to 10, Impact Projects at Year 11 to12, or optional Pathway Projects at Year 12 -13 which explores pathways beyond school. Students may also use PBL in their cross-curricular learning modules.

The purpose of learning through projects at School C is to give students opportunities to pursue their interests and passions in a purposeful and authentic cross-curricular learning experience. Partnerships are fostered with experts and businesses in the wider community. This partnership develops citizenship, as evidenced by the phrase 'We Not Me' that is used to describe Big Projects and 'Making a Difference', describing Impact Projects. Other skills that the school considers are developed in students engaging in project work are innovation, entrepreneurship, critical thinking, problem-solving, planning, and collaboration.

ii. Structure of the Impact Project programme

School C organises Impact Projects in three strands; Manaakitanga, Kaitiakitanga and Waihanga, and teachers (project guides) offer project themes under one of these strands. The project guide has some expertise or passion for the theme. Students opt into these projects, after some 'taster' workshops, with the expectation that although the project is initiated with the guide's idea, the student then drives exactly what the project will be and the direction it will go. All projects need to have an emphasis on having an external impact. Students are expected to develop their own action response or solution to the

need or problem identified and develop opportunities to collaborate with, and receive feedback from, authentic external partners.

Learning objectives clearly outline the values that Impact Projects are developing in students: Excellence, Inquiry, Innovation, Collaboration and Connectedness. There is also a well-defined design thinking project framework which outlines the phases of the project, based on design thinking models. The phases are Kick Off, Plan, Action, Reflection (which is woven into to all phases), and Showtime.

Comprehensive templates and rubrics have been developed to help guide students through the project phases. The rubrics give feedback on the planning, inquiry, and collaboration and connectedness aspects of the project. Alongside these assessment rubrics, NCEA standards are offered that align to the student's project. The project guide helps fit NCEA standards into the project by ensuring that the students meet the standards criteria in addition to the project outcomes. The standards are marked by the project guides and moderated by the teacher specialist in that particular subject.

Impact projects are carried out over a year in two consecutive, 80 minute blocks, once a week. Most teachers are involved in projects at School C unless there are timetable and contact time considerations.

c. Teacher and student attitudes towards PBL in the NCEA context from the questionnaire data

Demographic data from participants who responded to the questionnaire is shown in Figure 4.7

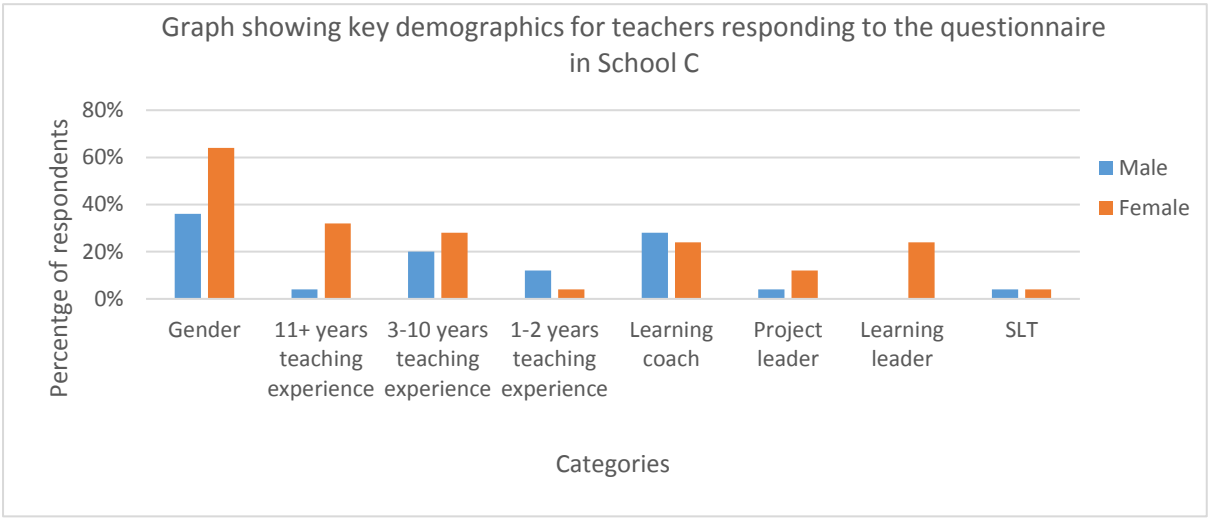

Figure 4.7 Graph showing key Teacher demographics in School C

i. Teacher attitudes towards PBL in the NCEA context

The responses of 25 teachers' responses to six questions on their attitudes towards PBL in the NCEA context, are summarised in the chart below:

Table 4.5 Percentage frequency of teacher responses to attitudes toward PBL in School C

Questions	Strongly disagree %	Disagree %	Neither agree nor disagree %	Agree %	Strongly agree %	Total %
Project-based learning is an effective teaching and learning strategy for engaging student interest and motivation.	0%	0%	0%	60%	40%	100%
Project-based learning is an effective teaching and learning strategy for achieving targeted learning outcomes.	0%	4%	12%	40%	44%	100%
Project-based learning is a learning strategy that should be used at NCEA levels.	0%	4%	12%	36%	48%	100%
Project based learning could be realistically implemented at NCEA levels.	0%	4%	12%	48%	36%	100%
Project-based learning helps to develop the capabilities that students need to become life-long learners.	0%	0%	8%	40%	52%	100%
Project-based learning is less effective if implemented in a cross-curricular manner than in single subject domains	32%	32%	24%	12%	0%	100%

In the survey, 100% of the teachers agree or strongly agree that PBL was an effective strategy for engaging student interest and motivation. This trend continued with attitudes towards PBL being effective for targeting learning outcomes and NCEA considerations, with over 80% of agree or strongly agree responses in those questions. 4% (or one person) disagreed with these statements and 12% were ambivalent.

Responders in the ambivalent or disagree category had concerns that were focused around the challenges associated with aligning NCEA standards, coverage of subjects, and managing students, rather than the effectiveness of projects as a learning strategy.

"Need strong management skills from the teaching perspective and making the standards used open enough to allow for project learning." Survey Teacher 25

Most respondents (92%) perceived that PBL helps to develop lifelong learning capabilities in students. The majority of teachers (64%) perceived PBL as more effective in a cross-curricular setting, with 24% ambivalent and 12% perceiving PBL to be more effective in the single subject domain.

ii. Student attitudes

Demographics

32 Year 12 students responded to the questionnaire; 18 males and 14 females.

Summary of attitudes towards PBL in the NCEA context

Student responses to three questions relating to their attitudes towards PBL at the NCEA level are summarised in the graph below:

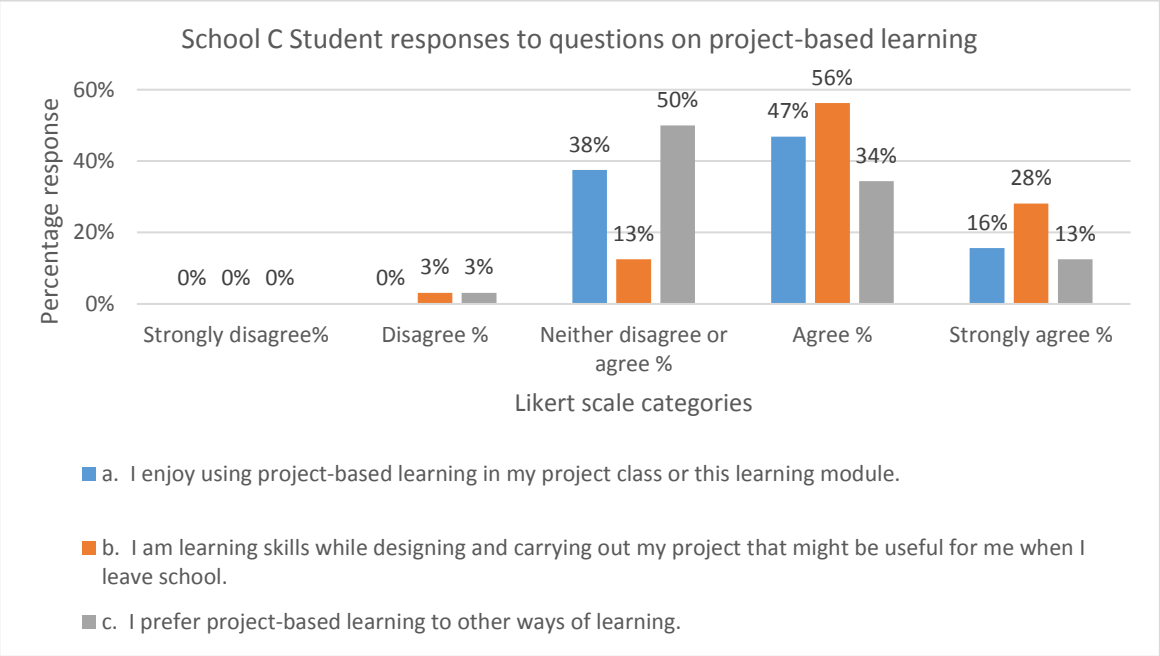

Figure 4.8 Graph showing frequency of student responses to attitudes towards PBL in School C

There were 63% of students who agree or strongly agree that they enjoy PBL, with 38% who neither agree nor disagree and no students who disagree with that statement. Most students see benefit in the PBL developing skills that will be useful to them in the future with only 13% who are ambivalent about this and 3% who disagree (one student). 47% prefer PBL over other types of learning, 50% who neither disagree nor agree with this and 3 % who do not prefer PBL over other ways of learning. The one student who disagrees in both questions attributed challenges in PBL to difficulties with different people. Other students who responded with neither disagree nor agree for all questions, described challenges with group work, time availability, and self-directed learning in PBL.

"Time restrictions. Peers not doing any work." Survey Student 15

"Sometimes not enough teaching when it is such a big project." Survey Student 16

Student motivation scales and attitudes towards PBL in the NCEA context.

Motivational factors had some effect on enjoyment of PBL with 33% of students in the high motivation group strongly agreeing that they enjoy using PBL compared to 0% of students in the lower motivation group. There was a higher percentage (53%) of students in the lower motivation group who neither disagree nor agree with the statement compared to 20% of student in the higher motivation group.

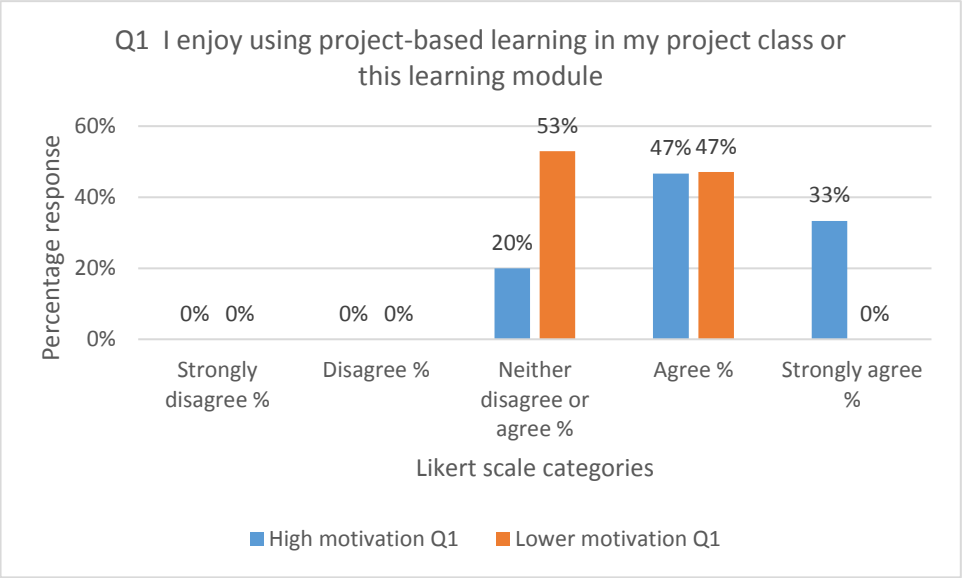

Figure 4.9 Graph showing the percentage differences in responses from students in the high motivation group compared to the lower motivational group

The Mann Whitney U test was applied to the data to look for statistical significance in Question 1.

Table 4.6 Mann-Whitney U test results

Test Statistics[a]

	Likert_response_Q1
Mann-Whitney U	65.500
Wilcoxon W	218.500
Z	-2.553
Asymp. Sig. (2-tailed)	.011
Exact Sig. [2*(1-tailed Sig.)]	.018[b]

a. Grouping Variable: Motivational_Level

b. Not corrected for ties.

The level of significance (2 tailed) is 0.011 which is statistically significant at the 0.05 level showing there is a statistical significance between the motivational groups and their enjoyment of PBL in the NCEA context, U =65.5, z=-2.553, p< 0.011, r= -0.45. The effect size is medium which indicates there is a medium difference in the ranked means between the two groups.

The perceived challenges regarding PBL in the lower motivation group were primarily related to self-management and self-efficacy issues and being able to self-direct their learning. Negotiating group dynamics successfully and accessing help were other challenges faced.

"Since everyone is doing lots of different things, sometimes it's hard to find help from classmates and teachers." Survey Student 22

"Getting demotivated and not being able to do it because not everyone is committed and so you don't get the project done … or just underestimated the time." Interview Student G1

However, this group also acknowledged that engaging in PBL was helpful in developing these skills to overcome the challenges but possibly the process of acquiring these skills was affecting their enjoyment of PBL.

"Teamwork based projects may also have problems at times but it is crucial that we know how to overcome these problems now than later." Survey Student 2

Students in the high motivation group acknowledged challenges but perceived they had strategies or skills to overcome them. The difficulties or pressures they faced did not outweigh their enjoyment of PBL, possibly as they attributed value in the skills and knowledge they were gaining from the experience.

"So for me personally the project isn't about NCEA, it isn't about my grades, it is kind of a way for me and like having this opportunity, the support I can get, to really do what I want to do in my life and what I want to achieve." Interview Student B2

"I enjoy being able to focus on one topic and apply knowledge to it in different ways, and learning how I can use the content we learn in class and adapt it to the focused project." Survey Student 8

d. Key themes emerging from the teacher and student interviews and open questions from the questionnaire data

i. Enablers of effective enactment of PBL in the NCEA context.

The most frequent responses (46) from teachers relate to opportunities for students to engage in authentic, real-life contexts they felt passionate about, and have a problem-solving response to a need or problem in the community. Students need to make strong collaborative connections with a partner in the wider community, which also has the effect of making students accountable to others instead of just their teacher or project guide. Students also considered these to be the important aspects of PBL, in addition to the opportunity to learn by collaborating with others who share a similar interest.

Teachers made frequent references (17) to the necessity of having a PBL framework, based on the design thinking model, which helped students to reach an outcome and sense of success. Projects also needed to draw together knowledge from different curriculum areas which contributed to deeper authentic learning (23 references).

"A way of drawing on students' cross curricula understandings and to apply this to a relevant (to them) context. An opportunity to develop the 'soft skills' evident in the front end of NZC." Survey Teacher 17

"I feel design thinking provides enough structure and scaffold for the students to be really creative and innovative ….it's not just kids off in all different directions, doing crazy things." Interview Teacher E

Teachers perceive their main role in projects as that of a guide, hence the term 'project guides' rather than teachers (24 responses). Teachers perceive that it is important to facilitate the learning in the projects, by careful planning, scaffolding, co-constructing, managing, and monitoring the students with their projects so that the students are ready to proceed and provoked into wanting to know more.

"I think the teacher needs to know how to provoke the students to want to know more. Like that emotional hook that makes them go "oh I wonder about", I think the teacher needs expertise in being a good project facilitator." Interview Teacher E

"There is a lot more effort that goes on at the beginning of the year to make sure that you have got your systems in place and then during the actual class, it is more about guiding the students and checking in on them." Interview Teacher B

Students also perceived the role of the teacher was to facilitate the learning process but also wanted teachers to have some expertise in the theme of the project and to be passionate about it.

ii. Benefits of PBL to the learner

The most frequent teacher responses (25) related to students being more motivated and engaged due to learning in authentic contexts with partners and developing the 21st century skills and other skills useful in future careers, like budgeting and project management.

"*I think it makes them very resourceful because really you need to do a lot of research and apply that research for a real world thing, not a fake real world like a lot of assessments … whereas projects, you actually get to help these organisations*." Interview Teacher C

Other sub-themes included being empowered to make a difference, learning to be empathetic with others, developing connections with the community, being able to communicate and collaborate with a diverse range of people, and developing potential pathways for future careers. Becoming agentic and learning how to self-manage was another sub-theme.

"Once you get kids leading the learning and get those external partners connecting with the kids, the stuff that they produce, like there's work that they are doing that potentially we could be publishing. The work that they are producing is real science." Interview Teacher B

"So it actually gives students the opportunity to learn to self-manage which they don't do if we are just telling them to sit down, now do this, this is the next step." Interview Teacher E

Greater coherency, deeper learning, and authentic assessment rather than credit hunting was another sub-theme.

"Students are more likely to become engaged in deep and authentic learning." Survey teacher 17

"Aligning curriculum, assessment and pedagogy to real world learning, rather than assessment driving things. Allowing assessment to fall out, more holistic views of knowledge allow for this." Survey Teacher 12

The sub-themes the students most frequently considered as benefits were that PBL increased their motivation and engagement towards learning by having the choice to engage in authentic learning contexts that make a difference. This helps to develop agency, self-management abilities, and 21st century or 'soft skills'.

"*I don't particularly enjoy the kind of very teacher-directed learning that we usually do on a regular module. I think it's* (sic-projects) *better*, *I enjoy it more, if we can do our own thing, it kind of simulates what real life is.*" Interview Student B1

Students also felt they benefitted from PBL as assessment was more authentic.

"Any assessments that we have to do are much more contextual, so any required skills and assessments feel integrated into the project." Survey Student 19

iii. Barriers to student success

The teachers did not consider that there were many barriers for students except for self-management difficulties. Other sub-themes from teachers included students choosing project themes because of their friends' preferences and then having difficulty maintaining motivation when they are not interested in the project. Difficulties in collaborating with other group members or communicating with stakeholders can also be a barrier. The students also consider these to be the main barriers. Other barriers students mentioned included the lack of time to complete projects and being outside their comfort zone when teacher support is unavailable.

Some teachers perceived that at the senior level some students did not value projects as much as in the junior school due to competing demands of other curriculum areas and NCEA credentialing, although this was not seen as a major problem.

"Most of them are still keen but there is a lot of asking instead of doing a project can I have some study time for example. So there are credits that come out of projects but it is a lot less credit dense then modules and spins." Interview Teacher A

iv. Challenges or barriers to implementation of PBL

School C has spent some time ensuring that there is shared philosophy and vision with regard to future-focused learning and have invested in internal

professional learning to help new teachers to the school to understand and engage with this. Teachers perceived that teacher capability and attitude can potentially be a barrier to implementation of PBL, particularly the shift in mind-set required in respect of their willingness to let go of some control, and how this might impact on curriculum coverage and NCEA.

"I think it is worth emphasising it is 100% teacher mind-set in my opinion, it is entirely dependent on the teachers willingness to let go of control but realise that they are still responsible and instead shift to how to nudge coaching servant leadership." Interview Teacher E

"That it is new learning for many teachers, they may need to be re-trained." Survey Teacher 22

The current challenges with implementation perceived by teachers that had the largest frequency of responses is the impact of NCEA and UE on PBL. Difficulties with NCEA standards aligning with project work and having teacher expertise to understand standards from different curriculum areas, as well as the willingness to share this expertise, is considered to be some of the main challenges. The UE requirements also impact on the number and domain-specific credits that students need to obtain. Barriers including external moderators needing to be more open to innovation and project-based assessment, was also mentioned.

"*There needs to be collaboration and dialogue with other curriculum areas, to ensure requirement and clarifications are understood clearly, by non-subject experts. It is a power shift that needs to happen, to ensure knowledge is not framed too tightly by subject experts.*" Survey Teacher 12

"*University Entrance, in my opinion, is forcing schools to do things in a certain way. So I feel like if universities required portfolios that showed your range of projects, for example, that shows you can project manage, you can manage a budget and all that kind of stuff, as opposed to you need so many credits from the small group of subjects without acknowledging any of the other stuff you've done, regardless of how successful or impressive it was.*" Interview Teacher E

Structural challenges perceived include effectively resourcing projects by having the requisite funding and staffing to run the projects. Potential issues could arise if there is not flexible timetabling, space, and collaborative co-teaching opportunities. Workload issues were also considered as a barrier, as management of many students with different projects can be physically exhausting.

The ongoing managing, monitoring, and tracking of students was also considered a barrier to implementation and for this reason it was considered crucial to have strong PBL processes, frameworks, and resources.

The work put in to engaging whānau by the school's leadership team over the years has helped to gain support for Impact Projects. Continued reflection and evaluating processes are also considered important, as is teacher enthusiasm, and willingness to share expertise.

"It is also important that teachers be excited about it. I really, really think that someone who is really negative about project-based learning, you know, solely looking after a project or a class doing project-based learning, is going to be a recipe for disaster." Interview Teacher A

v. Future development of Impact Projects

The main sub-theme is that teachers would like to have some more project specific standards to alleviate the pressure of trying to align standards that don't quite fit to projects and dealing with differing moderation advice. Standards could also be more user friendly in terms of acknowledging collaboration and group assessment.

"That would be a dream, it would be a dream because finding standards to align, either internal or external, which aligned to a particular project, is hard work." Interview Teacher A

"I definitely think that achievement standards could have a revisit to have more of a focus on collaborative project-based learning." Interview Teacher E

4.5. Cross-Case Analysis

In this section, similarities and differences between the three case studies are identified by analysing and comparing the data in each case. It is important to convey the features that each case has in common but also describe the unique features of each case that result from differences in the structure of the PBL programme (Stake, 2006). A modified version of Stake's (2006) matrix for generating theme-based assertions from case findings rated important (Worksheet 5A), is used to merge the cases (see Appendix M). The merged findings are presented in a separate chart for the questionnaire, followed by a summary of key similarities and differences across the cases for different themes.

Table 4.7 Key questionnaire data and implementation comparisons

Categories or themes	Case study 1 School A	Case study 2 School B	Case study 3 School C
Roll	~1400	~500	~600
Description of school	Yr 7-13 co-educational school, decile 6	Yr 7-13 co-educational Catholic school, decile 6	Yr 9-13 co-educational school, decile 10
School established and school buildings	Established within the last decade. Modern learning environment (MLE)	Established in the 1980"s. Newly refurbished, mostly MLE	Established within the last decade. MLE
PBL implemented across senior school	No	Yes	Yes
Cross-curricular approach	Yes	Yes	Yes
PBL optional for the students	Yes	No	No
PBL time allocation for Year 12's	Ten ~100 minute blocks per 30 block cycle	Three 100 minute blocks, one on Wed, two on Friday	Two 80 minute consecutive blocks per week
Majority of surveyed teachers are involved in running projects	No	Yes	Yes
PBL an integral part of all the learning	Yes – future focus class uses PBL as a structure for all learning except for 3 subjects at Year12	No - Impact Projects are separate from other subjects	No -Impact Projects are separate from other learning modules
Percentage of teachers that agree or strongly agree that PBL is a learning strategy that should be used at the NCEA level	52%	38%	84%
Percentage of teachers that agree or strongly agree that PBL is an effective strategy for engaging student interest and motivation	70%	46%	100%
Percentage of teachers that disagree or strongly disagree that PBL is less effective if implemented in cross-curricular manner	33%	53%	64%
Percentage of students who agree or strongly agree they enjoy PBL (Q1)	88%	20%	63%
Percentage of students who disagree or strongly disagree they enjoy PBL (Q1)	0%	55%	0%
Percentage of students who agree or strongly agree that they prefer PBL to other ways of learning (Q3)	76%	18%	47%
Statistical significance between high and lower motivations groups for Q1 – enjoyment of PBL	Yes $p<0.019$ Effect size large	Yes $p<0.000$ Effect size large	Yes $p<0.011$ Effect size medium

a. Summary of key similarities and differences in emerging themes

Schools A, B and C are similar with regard to being a full co-educational secondary school, with School A and B catering for Years 7 to 13 and School C Years 9 to 13. School A and C are recently established and have modern learning environments whereas School B is an established school that has been recently refurbished to provide a more modern learning environment.

All schools have implemented their PBL programme in a cross-curricular manner but only School A has an optional, fully integrated PBL programme that is the overarching structure for all learning. Schools B and C offer PBL as a compulsory Impact Project module that stands alongside other learning subjects or modules. The optional aspect of School A's programme may reflect the high percentage (76% in Q3 in the student survey) of students surveyed and in the PBL programme, who prefer this type of learning. School A allocates the most time for students to engage in PBL, followed by School B then C.

Teacher demographic data was not compared between schools due to the lower number of responses from School B. However, the teachers surveyed in School B and C were involved in Impact Projects but some teachers surveyed in School A were not involved in the Future Focus programme. School C has the highest percentage of teacher positive views towards PBL in the NCEA context, with School B having the lowest percentage of positive attitudes except with regard to the effectiveness of PBL when used in a cross-curricular manner. School A scored lower in this aspect possibly due to only a few teachers being involved in their cross-curricular PBL programme, so current experience of using this strategy is more likely to be in siloed subject areas.

School A, which has an optional PBL Future Focus programme, has the highest percentage of students valuing the PBL experience, with 0% of students who did not value PBL. School C also had 0 % of students who did not value the PBL experience, however, more students were ambivalent about PBL than in School A. School B had the lowest percentage of students who valued PBL.

There was a statistical significance in the difference between the high and lower motivation groups and enjoyment of PBL found in all schools, particularly in School B. Interview and open question data was used to analyse whether there was a difference in the student's ability to self-direct and self-manage.

A chart, based on Stake's (2006) matrix for generating theme-based assertions rated important, was used to analyse the merged data (see Appendix M).

The following similarities and differences in findings in the merged themes based on the chart in Appendix M were identified.

i. Defining factors in enablers of effective enactment of PBL in the NCEA context

Findings can be clustered into five main groups. The first of these is the purpose of PBL and there is a strong consensus between schools, except for some students in School B, that PBL needs to have an impact in the community and link with external partners. In School B, although there was agreement that projects needed to have some impact, there was tension surrounding what was an acceptable level of impact that a project needed to make on the community. This resulted in some students having their projects vetoed by teachers.

The second group of findings relates to developing deeper engagement of thinking by promoting student self-directed learning. This occurs by allowing students to choose authentic and meaningful projects that interest them and support their responses to real life issues or problems over an extended period of time. There was strong support for this theme in all schools, although the students in School B felt their agency was compromised by teacher interference regarding what constituted an acceptable level of impact on the community. This may be part of the reason why only 20% of the Year 12 students in School B enjoy PBL.

The third group of findings is comprised of cross-curricular infrastructure factors that support PBL design, such as design thinking frameworks, assessment rubrics, and templates to support the phases of the project. There was some variation in emphasis in this finding between the schools, with School B using a less consistent inquiry framework.

The fourth group of findings relates to the impact of competing influences such as NCEA credentialing and aligning standards to projects. Again, there is some variation in how important schools perceive projects needing to, or being able, to effectively offer NCEA credentialing, depending on the structure of the PBL programme. School B had the lowest support for the notion that PBL was a strategy that should be used in the NCEA context. The last factor relates to the change in the role of the teacher in PBL to a greater facilitative role and there was strong consensus in all schools of the importance regarding this theme.

ii. Benefits of PBL to learners

The findings in this theme are centralised around benefits in increasing student motivation. Student motivation in PBL can be contextualised in three ways. The first is that motivation is increased by stimulation of interest due to personalised choice and agency. This increased interest facilitates the gaining of meaningful knowledge and understanding in an authentic context. All schools placed a high importance on this aspect.

The next way motivation is increased is due to the utility aspect of PBL, which is the useful skills the students gain from PBL that helps them to get something specific that they want. This includes skills such as 21st century skills or employability skills and reduced workload to gain NCEA credits, which they perceive will help them in the future. Again there was strong support from all schools in this aspect, although there were competing NCEA demands in School B.

The last aspect of motivation relates to how PBL can build capabilities that increase self-efficacy, such as being able to think more deeply, connect learning from different areas, develop a sense of personal effectiveness, and ability to self-manage. It also includes being able to connect effectively with others and being empowered to make a difference. The Year 12 students in School B did not value the importance of this as highly as the students in other schools. This is reflected in this school's low percentage of students who enjoy PBL. This could be linked to the students' perceived imbalance between opportunities to gain NCEA credits more readily from non-project based subjects than Impact Projects and understandings regarding the importance of building capabilities.

In School B, some students' level of disengagement with Impact Projects due to the lower value placed on it, may also have affected the teachers' lower percentage (46%) rating for PBL being an effective strategy for engaging student interest and motivation. There was a statistical significance in the relationship of the high compared to the lower motivated groups and their enjoyment of PBL, especially in School B.

iii. Barriers to student success using PBL

Four main factors illustrate the findings in this theme. The first is the lack of access to project structures, tools and methodologies, and the level and quality of teacher support. There were variations between the schools as to the recognition and commitment to this factor. The second factor is the level of internalised self-management that leads to perseverance with the project. All schools placed high importance on this factor. The third factor is the impact of NCEA competing with the focus and energy that students need to put into PBL. School B placed a higher importance on this factor compared to the other case study schools. However, School A placed high importance on the impact NCEA has on anxiety levels, probably due to the high risk of the integrated nature of their PBL programme, where NCEA credits are gained predominantly from their projects. The last factor is relational issues with project group dynamics and stakeholders or external partners. There was variation in the schools relating to the importance of this factor.

iv. Challenges or barriers to implementation of PBL

The findings in this theme are grouped into five main factors. The first is the challenge of NCEA's competing focus with PBL, with perceptions of credentialing being compromised and difficulties with aligning current standards to projects. This is a recurring theme throughout all case studies and is perceived as having a strong impact on PBL.

The second factor is structural issues which includes organisational structures and management and monitoring of the student projects. There were variations of importance placed on this factor due to the variation in the features of the schools' implementation of PBL. The variation in the findings may link to whether the school is recently established and PBL has always been a part of

their programme, or has been introduced into an established school, as in School B.

The next factor is teacher capability, particularly relating to a lack of professional learning about PBL in a New Zealand context and having a toolkit to enable teachers to feel effective in facilitating PBL. Also included in this factor are feelings of compromising NCEA credentialing due to lack of expertise in different subject areas. Most schools found this factor to be important although School C placed a lower importance on the need for external professional learning, relying on in-house expertise for professional learning instead. Teacher attitude or mind-set towards PBL in terms of enthusiasm, willingness to collaborate, and take a risk to change one's practice was seen as an important challenge. School C rated this lower, possibly due to feeling that the culture of the school encouraged growth mind-sets towards PBL, so it was not a current challenge.

Lastly the factor of organisational integration and commitment towards PBL as a school community and also a wider community was an important factor, although variations exist in the three schools due to how far along the PBL journey they currently perceived they were.

v. Future development of PBL

The first finding is the desire of all the schools to have project specific standards developed. This is rated as very important as is the need for the current standards to be more open to alternate ways of assessing, including group work. The last finding relates to ideas about changing school structures to be more flexible to allow the implementation of PBL to be more effective. School C rated this as less important due to existing flexibilities in their schools' structure.

4.6. Summary

The merging of the data from each of the case study schools has revealed some strong findings, as indicated in the section above. The variation in the findings is due to the importance of each element of the findings in each school and this relates to the variation in the implementation features of PBL and the existing structures in each school.

Motivational constructs also have an impact on the value that is placed on PBL in the NCEA context. The value placed on the capabilities students develop by engaging in PBL is directly related to the perceptions of how effective this strategy is in the NCEA credentialing. The potential benefits for the students from engaging in PBL are strong findings across all schools, but there is a tension with competing demands of NCEA. The culture of the school and existing school structures may also have an impact on this.

Strong findings emerged in the challenges to PBL implementation which mainly relates to how to fit PBL into existing school structures, strongly held positions on the values of traditional views of pedagogy and what is perceived to be the purpose of learning, and the NCEA assessment system.

These findings will be discussed further and linked to existing literature in the following chapter.

CHAPTER FIVE: Discussion

5.1. Introduction

The last chapter outlined the findings from the three case study schools. This chapter discusses the findings that are pertinent to the research questions and is structured by discussing each question in turn, linking the findings with relevant literature.

This research study set out to investigate the following questions:

- How can cross-curricular project-based learning be implemented at the NCEA level in New Zealand secondary schools?
- What are the benefits of implementing cross-curricular project-based learning in the NCEA context, from a student and teacher perspective?
- Are there differences in perspectives about project-based learning in students with high motivation levels compared to students with lower motivation levels?
- What factors enable or constraint the implementation and enactment of cross-curricular project-based learning at the NCEA level in New Zealand secondary schools?

5.2. How can cross-curricular project-based learning be implemented at the NCEA level in New Zealand secondary schools?

The impetus for investigating how project-based learning (PBL) can be implemented in the NCEA context in New Zealand schools arose, in part, from the lack of current New Zealand based literature in this area. The research findings from three case study schools show that PBL can be implemented in this environment and Chapter 4 outlines in detail how each school has implemented PBL in the NCEA context.

Although the case studies have similar features associated with their PBL programmes, each programme operates in a unique context and environment,

which includes complexities that exist from the interaction of different people within the school and in the wider community. As a result, slightly different PBL models have developed. Schools B and C have structured their compulsory cross-curricular PBL programmes to stand alongside other blocks of learning. Timetable structure in the schools allows for extended periods of time for students to work on their projects, which enables collaboration, especially with external partners. To provide differentiated scaffolding for students to initially develop their projects, teachers offer broad themes that students can opt into, either working individually or in groups. In School C, once the student has chosen the theme, they can then drive the direction of the project within the broad theme, depending on their interests and passions. School B has differentiated project themes that are either teacher-facilitated, where students are free to choose their own theme, or teacher-directed, where the teacher sets the theme and the direction the projects will take. The teacher-directed projects were designed to provide more support for less self-directed learners. Both schools call their PBL programmes at the senior level ‘Impact Projects’. This reflects the purpose of the projects, which is to support students to respond to an issue, need, or problem identified in the community in an authentic way that will then result in making a difference or solving a problem. It is important that students connect with partners or stakeholders in the community, in order to respond to the issue. NCEA standards are aligned to the students’ projects as applicable and the work completed as part of the project process is adapted to fit the standards.

School A has adopted an optional, integrated cross-curricular approach to PBL called ‘Future Focus’ and it is the primary approach for all learning. Different teachers work with the students in different time slots to provide a range of expertise that students can draw on for their projects. Some additional subjects are taken, especially in Year 12, to mitigate the risk of not obtaining University Entrance credentialing and provides the opportunity to gain NCEA credits. All other credits are planned for and ‘fall out’ of the student’s project. ‘Taster’ workshops, similar to the process in School B and C, are provided initially to provoke driving or focussing questions that will help students frame their projects. After the initial provocation students are then completely free to design

a project that is sparked by their interest or passion. As opposed to the other two schools, most students are working independently, rather than in groups, but collaborate with others in the Future Focus class to refine ideas. However, the purpose of the project is the same as in School B and C, in that an impact needs to be made. The students are supported to respond to the identified issues or needs and connect with community stakeholders.

All schools have modern learning environments, which help to provide flexible spaces. However, teachers who were interviewed believe the projects can be effectively run in traditional spaces, especially if the whole school is timetabled for PBL at the same time, as timetabling can create more flexible spaces and teacher availability.

The PBL programmes in all three schools were cross-curricular, drawing on different curriculum areas depending on the direction of the students' projects. In School C there is also some PBL occurring in learning modules, although these are generally cross-curricular as well. This approach is less common in the literature related to the benefits of PBL (Condliffe et al., 2017), with PBL often being used in the STEM and social science subjects. However, there is evidence of schools, especially in the USA, which use PBL as the primary vehicle for learning (Aslan & Reigeluth, 2015). Teachers in the case studies feel that cross-curricular PBL helps students to experience coherence in their learning, although PBL in siloed subjects can also contribute to deeper learning. Regardless of where PBL is positioned, the same design features frame the process, with an outcome, solution, product, or artefact shared and showcased at the end of the process. There may sometimes be less emphasis on the strength of the community connection in siloed subjects, depending on the nature of the project.

Most teachers using PBL suggest that the disciplinary knowledge needed to develop new knowledge to help create solutions to problems, is gained on a 'need-to-know' basis and the provocations in the initial phase of the design thinking process gives students a reason to want to know more. They consider that the learning is also deeper because the students care more about it, and

therefore are motivated to extend their understanding about the project context. Students can collaborate and seek expert assistance to gain disciplinary and epistemological knowledge from their project teacher, from other teachers in the school with different expertise, or from experts in the community. Gaps in skills or knowledge can be supplemented with more teacher-directed workshops, so both teachers and students are co-constructing the student's personalised learning programme within the project. This may help to allay concerns (Gerritsen, 2018; Rata, 2018), relating to PBL not being academically robust, although this remains an ongoing tension amongst educators.

5.3. What are the benefits of implementing cross-curricular project-based learning in the NCEA context, from a student and teacher perspective?

The case study research findings show that from the teacher and student perspective, there are clear benefits for the learner from engaging in PBL in the NCEA context.

The first benefit that had a high frequency of responses, from both teachers and students, is that PBL increases engagement in learning due to personalised choice and interest. This was also reflected by teachers and students in School B, despite having the lowest percentage of students who enjoyed PBL and teachers who thought PBL was an effective strategy for engaging student interest. Given that increased interest in learning due to choice and autonomy can help to increase intrinsic motivation, learners are more likely to be engaged in a task under their own volition. This helps learners to have higher levels of self-determining behaviours, leading to greater self-regulation (Ryan & Deci, 2000; Wentzel & Brophy, 2014). PBL, through increasing intrinsic motivation, empowers learners to have agency, and therefore, helps to develop self-directedness or self-regulation in learners (Bell, 2010; Meyer & Wurdinger, 2016; OECD, 2018a). Self-regulation relates to the concept of managing self which is one of the key competencies in the New Zealand Curriculum (NZC) and is central to learning and relating to others effectively (Ministry of Education, 2012).

Secondly, PBL is an innovative strategy that helps learners develop 21st century skills or 'soft skills' whilst engaging in meaningful learning in authentic contexts (Barron & Darling-Hammond, 2008a; Bell, 2010; Larmer et al., 2015; OECD, 2018b; Wagner & Compton, 2012). Teachers and students said that PBL helped students to gain 21st century or employability skills that would help them in the future. In particular, they mentioned developing the ability to communicate and collaborate with others in a meaningful and authentic way and develop skills in team work, problem-solving, creativity, leadership, perseverance, and initiative. These are all skills that have been acknowledged as important in helping equip young people with the skills-sets needed to navigate 'post-normal' times and develop into the innovative, creative and collaborative problem-solvers who can attempt to resolve 'wicked' problems and be active participants in creating their preferred future (Bolstad et al., 2012; Claxton, 2008; Gilbert, 2014; Sardar, 2010; Trilling & Fadel, 2009). The NZC, with its future-focused principle, also acknowledges the importance of learners having adaptive expertise skills to enable them to address significant future issues (Ministry of Education, 2007).

There were tensions, however, for some teachers and students, especially in School B, between the time assigned to PBL compared to competing demands of NCEA in other subjects. Some students felt other subjects were more important as it was easier for them to gain credits, which they thought was more valuable for their future. This tension between valuing NCEA accreditation over developing capabilities and competencies may have contributed to some disengagement with projects and could account for the lower percentage of enjoyment of PBL by some students in School B. This attitude was not prevalent in School A and C. Students in School A had opted into the Future Focus programme, which may suggest that they valued developing capabilities and competencies as well as gaining NCEA credits in an authentic, integrated manner. Teachers and students in the Future Focus programme, felt that using the same piece of work as the basis for different NCEA standards, reduced workload. In School C, although the Impact Project was compulsory, the learning culture in the school meant that students generally valued the skills they were gaining by engaging in PBL. They also saw the benefit in gaining

NCEA credits in an integrated manner that was personally meaningful to them. This suggests that time spent on developing a learning culture in a school that embraces strategies like PBL is essential if students are to enjoy PBL in the NCEA context.

Thirdly, teachers stated that PBL can help learners to think more deeply and connect learning from different disciplines, which increases coherency in learning. They believe that projects connect students with the real world and makes the learning meaningful, whilst also giving students opportunities to learn from experts outside of the school environment. The connection with community partners and stakeholders in order to solve a problem or address an issue, also helps students to engage with the wider community, develop empathy, and have opportunities to experience potential career pathways. It also gives them an opportunity to make a difference, which is empowering for learners. This collaborative and community knowledge building encourages design thinking mind-sets (Bereiter & Scardamalia, 2014). The Ministerial Advisory Group stated that PBL, when done well, helps to integrate learning from different disciplines and notes that PBL reflects the way in which the world works, so learners should be experiencing that before moving on from school (Ministry of Education, 2019a).

Teachers, particularly in Schools A and C, believe that with good project planning and management, deeper disciplinary understanding and thinking comes as a result of authentic and collaborative opportunities to engage in meaningful contexts. This is motivating to the learner whilst promoting the development of 21st century skills. This is supported by findings, particularly in the STEM context, that PBL is at least equivalent to, or slightly better at, developing higher cognitive skills, critical thinking, and understanding compared to other instructional methods (Condliffe et al., 2017; Geier et al., 2008; Holmes & Hwang, 2016; Mioduser & Betzer, 2008; Thomas, 2000). However, this is refuted by others in the wider education sector, particularly in the university environment, that believe disciplinary and epistemological knowledge needs to come before inquiry processes like project-based learning (Gerritsen, 2018; Johnston et al., 2017; Rata, 2018).

5.4. Are there differences in perspectives about project-based learning in students with high motivation levels compared to students with lower motivation levels?

There was a statistically significant higher percentage of students in the high motivation group who enjoyed PBL compared to those students in the lower motivation group based on the comparative difference in the ranked means between the groups. The tool used to help categorise the two groups was mainly testing motivational aspects of goal orientation, task value, and self-efficacy, rather than metacognition. The difference in the students' perspectives in respect to their enjoyment of PBL was affected by the value that they placed on it, which was partly influenced by how they viewed the competing demands of NCEA. However, the main barrier or challenge to PBL that the students identified was their ability to self-manage. Even though students may have valued the project task due to personal interest and choice, students in all case study schools articulated difficulties with self-management. The students in the high motivation group seemed to be more optimistic about their ability to develop self-management skills and had the determination to persevere with their projects, despite setbacks. If the students in the high motivation group had greater self-efficacy and valued the project task, it may indicate they have the growth mind-set (Dweck, 2008) to believe they can overcome challenges by making efforts to persist with their project goals. This also relates to Ryan and Decis's (2000) model of self-determination, which occurs when learners have autonomy, connectedness, and competence. The competence in this context could relate to self-efficacy of knowing they "can do it" (St George et al., 2014, p. 127) and enjoyment of the freedom to create their own goals (Loyens, Magda, & Rikers, 2008).

PBL provides opportunities for students to choose the theme and direction of their project so there are multiple opportunities to engage in self-directed learning. The ability to be a self-directed learner is often used synonymously with self-regulated ability. Loyens et al., (2008) explains that self-regulation can be developed in learners in a teacher-directed environment as well as a learner-

directed environment, so the ability to self-direct is more applicable to PBL where student choice is an integral feature of the learning experience. As in self-regulated learning, having self-directed learning abilities refers to the learner having metacognition or the ability to 'think about how to think', self-manage, self-reflect, and choose adaptive learning methods (Loyens et al., 2008; Zimmerman, 2002). The beliefs and emotions the learner has affects their ability to achieve their learning goals (Loyens et al., 2008; Zimmerman, 2002).

In order for students with lower motivation to enjoy and engage with projects successfully, teachers should be mindful of students' causal attributions and self-efficacy mind-sets and give differentiated, scaffolded support to help build confidence in the students. Students need to see projects as realistically achievable and as the teachers in all the case study schools articulated, teachers need to help manage and monitor that process for the students, to ensure momentum is maintained. English and Kitsantas (2013) found in their research study that in order for teachers to develop self-regulation in students, they need to have a facilitative role where they guide students through the PBL process, encouraging reflection and providing scaffolding and feedback. Teachers need to have strong learning relationships and interactions with the students who they are mentoring. Teachers need to be able to deal with a range of students within their group, as some will be self-directing, others will be at a guided choice stage and others at a more teacher-directed stage. Just as in other types of learning, students need to be assisted in learning how to learn in that particular context and adjust to working with more self-discipline. Expecting all students to be able to self-direct their learning in projects from the outset is unrealistic (Holmes & Hwang, 2016). Managing group dynamics was also a factor identified for teachers to be aware of in group projects and assigning group roles could help with this (Holmes & Hwang, 2016).

5.5. What factors enable or constraint the implementation and enactment of cross-curricular project-based learning at the NCEA level in New Zealand secondary schools?

Successful implementation of PBL in the NCEA context is contingent on a range of factors. PBL is pedagogically worthy (Barron & Darling-Hammond, 2008a; Bell, 2010; Boss & Larmer, 2018; Holm, 2011; Krajcik & Shin, 2014; Larmer et al., 2015), but if it is to be implemented there needs to be an awareness of these factors and an understanding of how to navigate around them in order for PBL to be a successful learning strategy at the NCEA level.

a. The competing demands of NCEA and the UE imperative

Teachers and students considered that NCEA has a powerful impact on PBL in the senior school. The case study schools have made considerable efforts to ensure that the projects in which the students engage, offer the opportunity to gain NCEA credits that are relevant to the project theme. There are some existing standards that align well to some projects, especially those that have an inquiry, action, presentation, or product development focus. These standards may soon change, however, in the current NCEA review of achievement standards (Ministry of Education, 2019b). Generally project teachers do not find it an easy task to manage and plan the process especially if the standard that aligns to the project is not in the teacher's area of expertise. External moderation can also add to the difficulties especially if the external moderator does not have an understanding of the PBL process and acceptance of a diverse range of contexts. The recognition of alternate ways of assessing the learning and the place of group work is also a source of contention. Currently the 'soft skills' and competencies that are intrinsically part of the value-added aspect of PBL are not valued and recognised by NCEA standards (Hipkins & Cameron, 2018). Current literature outside of the New Zealand context also acknowledges there is a need to develop assessments that are more closely aligned to PBL and the 21st century skills it develops (Bell, 2010; Boss & Larmer, 2018; Hixson et al., 2012).

In effect, although projects will allow students to gain credits, some students and teachers perceive that it is more difficult and higher risk to try to achieve them through projects than in traditional subjects. There was some variation between the schools regarding anxiety relating to credit acquisition depending on how PBL was implemented. School B and C's project programme did not rely on projects to carry much credit load, in comparison to School A's integrated programme. However the time invested in projects, especially in School B, increased anxiety about having reduced time available in other traditional subjects to gain the desired credits. Some teachers and students in School B felt that the three 100 minute blocks invested in Impact Projects, prevented them from investing the desired time in other NCEA subjects that they perceived were more valuable to them in terms of gaining NCEA credits and subject-specific disciplinary understanding.

The 'assessment driving the learning' and 'credit hunting' mentality than exists in New Zealand secondary schools, rather than the preferred scenario where the curriculum drives the learning, has been well documented (Hipkins et al., 2016). PBL promotes the focus on learning goals rather than assessment goals and helps to equip learners with valuable skills for life beyond school, so it would be useful if NCEA standards enabled PBL rather than hindered it. Teachers and students in the case study schools strongly support the introduction of project specific standards that recognise the inquiry process across a diverse range of contexts. Project specific standards with criteria that assessed the ability to inquire, plan, problem solve, collaborate, and connect were some of the suggestions for potential assessment opportunities. Some students in School A also thought it would be a 'game changer' if the project standards were a recognised domain for UE. UE requirements are currently seen by some teachers as a hindrance to innovative cross-curricular learning programmes such as PBL, as they restrict coherent programmes of learning by requiring students to gain 14 credits in three separate subject domains.

If PBL is to be successfully implemented at the NCEA level, the 2020 Review of Achievement Standards team (Ministry of Education, 2019b) should address some of these issues as it develops the new NCEA standards. This could

include not only developing project specific standards but also ensuring that there are a range of other new standards that can be adapted to fit a range of local project contexts across different curriculum areas and recognise alternative assessment methods and collaborative group work. This was also a recommendation in the Ministerial Advisory Group in the recent NCEA review to, “Develop new standards to credential exploratory or project work” (Ministry of Education, 2019a, p. 35). They also recommended at NCEA Level One to “Develop a set of standards specifically designed to assess project based learning (PBL) and provide quality exemplars of how existing standards can be grouped to effectively assess and credential learning via PBL” (Ministry of Education, 2019a, p. 40). Bradley-Levine et al. (2010), suggests that it is not fair to ask teachers to ‘straddle’ two different paradigms, so alternative models of assessment should be created that assess the PBL skill sets more effectively.

Changing student mind-sets about credit accumulation continues to be a challenge for teachers who are using PBL, especially in schools that are implementing it for the first time and in established schools, as in School B. Teachers articulated that it was also important to continue to engage with whānau to help further understanding of the purpose of learning and the advantages for their tamariki to develop skills and capabilities for life beyond school, rather than just accumulating NCEA credits.

b. School organisational structures

In order to promote innovative thinking and provide opportunities for students to develop connections with others within and outside the school community, flexible timetable structures need to be in place to allow for extended periods of time to engage in PBL. All schools in the case studies have organised their timetables into time-rich blocks of at least 100 minutes.

Running compulsory PBL programmes simultaneously (i.e. suspending the normal timetable) throughout the levels in the school helped to make learning spaces and teachers more available. This was evident in School B and C, where they had much more flexibility in organising groups of students together

who had similar project themes. Having PBL running throughout the school also allows strategic resourcing and structural factors to support PBL (Hendry et al., 2017). It has the effect of adding to collective 'buy-in' as all teacher can share experiences. It also helps to break down mind-sets surrounding traditional siloed subjects as teachers under PBL were project guides, facilitating the project learning in a cross-curricular manner, rather than a specific subject teacher. However, it was a common theme amongst students and teachers that it was more effective if the teacher had a passion or some expertise relating to the project theme. School A had adopted a more high-risk model (in terms of NCEA credentialing), where PBL integrated much of the learning and this ran concurrently with the other traditional senior subjects. It is considered a worthy endeavour as illustrated by the student quote:

"*I found that in Future Focus doing the work the way we do, I just feel I have learnt from it a lot more than in the past 12 years of learning.*" Interview Student D

However, there have been challenges for School A to make it fit within existing structures, especially allowing students to access specialist learning spaces and expertise from other teachers outside of the Future Focus programme and giving sufficient time for the teachers involved in Future Focus to collaborate and reflect. Suggested solutions included having a Commons approach whereby Future Focus students are all in a common space, clustered into similar project themes, and all project teachers are co-teaching in that space. This would require a greater uptake by the students, which relates back to reducing the anxiety about NCEA credentialing, and more resourcing of teachers and available time.

Regardless of the way in which PBL is organised, there is a need to resource adequate staffing and budgets for projects. There also needs to be adequate time resourcing for teachers to collaborate without creating further workload issues. Literature suggests that it may be easier for smaller schools to accommodate this and provide opportunities for teachers to collaborate and interact, compared to larger schools (Ravitz, 2010).

c. Creating a school PBL culture

Teacher and students in all schools reflected how the role of the teacher changes in PBL. This role is one of facilitation, guiding, and mentoring rather than directing. Implicit in this change of role is the teacher's ability to be able to release some control, which will enable students to be more autonomous and choose their learning direction (Barron & Darling-Hammond, 2010; Ertmer & Simons, 2006). To be able to facilitate the learning requires a shift in practice and having a mind-set that believes that a PBL learner-centred approach will optimise outcomes and develop future-focussed competencies in learners (Dweck, 2008; Rogers et al., 2011; Tamim & Grant, 2013).

Changing one's practise and relinquishing some control is a risk especially in a high-stakes assessment environment like NCEA, so it is important that teachers are supported by the school leadership and their communities in their endeavours to build capabilities in PBL (Bradley-Levine et al., 2010; Dole et al., 2015). To develop a PBL culture in the school there needs be strong, supportive leadership that helps staff to commit to change by establishing a collective purpose (Fullan, 2007). Teachers need to share this collective purpose with students and develop a shared PBL culture and language within the school (Hendry et al., 2017).

The students in most of the case study schools were noticeably able to articulate the purpose of PBL and used the same language as the teacher in describing the 21st century skills that PBL afforded. However, not all case study schools had students who valued the opportunities that PBL offered in building 21st century capacities or to be an autonomous learner. Some students, particularly in School B believed it was the teacher's job to tell them what to do and they preferred to be told what to learn in order to gain the NCEA credits. For a learner-centred strategy like PBL to be adopted, schools need to be prepared to help students develop a different mind-set about their learning (Aslan & Reigeluth, 2015). Ravitz (2010) reported that smaller 'start-up' schools were more successful at implementing PBL and hypothesised that this was because it was easier to establish a shared culture from the beginning. This did seem to reflect the situation in School C, where there was strong support for

PBL from teachers and there were no students surveyed who did not enjoy PBL. It also suggests that established schools, such as School B, may find it more difficult to establish a shared learning culture that embraces learner-centred strategies, such as PBL. Established schools would need to continue to make ongoing efforts to establish a collective purpose regarding PBL, within the teacher and student community.

There was a strong theme in all schools that facilitating PBL was physically exhausting, due to the time involved and the monitoring and mentoring that needed to occur with a diverse range of student projects. This was also reported in the Bolstad et al. (2012) report on Future-orientated learning in New Zealand. Building teacher capability in project management skills is imperative and resourcing needs to provide adequate on-going professional learning that allows teachers to develop confidence, resources and strategies by collaborating with others and having first-hand experiences in PBL environments (Dole et al., 2015). The teachers in the case study schools reported that there were no external professional learning providers that they knew of who could provide the professional learning they needed regarding PBL in a New Zealand secondary school NCEA context. Wolking (2018) also reported this finding in his report that investigated how to support key competencies in New Zealand secondary schools. Teachers in the case study schools said that most PBL professional learning was provided 'in-house'. It may be important for schools to develop a non-competitive, collaborative professional learning approach with other schools to support each other in PBL endeavours. The Ministerial Advisory Group for the NCEA review stated that "many differing assumptions and perceptions exist about PBL and research is scarce, so sharing effective examples of PBL in action is vital to dispel myths and encourage diversification" (Ministry of Education, 2019a, p. 46). It may also be useful for educators to look outside of the school environment into other sectors to gain a wider perspective of project management, thus avoiding the 'echo chamber' that can exist when ideas are only shared within the same group (Myburgh, 2018). There is also a wealth of information available on-line regarding PBL, especially from the USA on websites run by organisations like the Buck Institute for Education and Edutopia. Links can also be found to a

multitude of information and PBL conversations from social media such as Twitter. However this has time implications for teachers who are already under considerable workload pressures (New Zealand Post Primary Teachers Association, 2016).

d. PBL process features that help to ensure it is an effective learning strategy

Although the implementation structure in the three schools have variations in how they have implemented PBL in the senior school, there are common features of the PBL in all schools that have optimised the benefits students receive from this approach to learning. Whilst all PBL programmes in the case study schools have incorporated the features of the Gold Standard PBL essential design elements (Larmer et al., 2015), they have added another layer to the purpose of the PBL. They all share the philosophy that projects should address an authentic issue, need, or problem identified in their communities and the students need to develop connections with relevant external partners or stakeholders in the community. The student's response to the identified issue needs to be supported to help them make a meaningful difference or an impact in the community. This helps students to have empowering, authentic learning experiences that connect them to the real world and their communities and engage in meaningful collaboration. It also adds to the accountability aspect by being responsible to external partners, rather than just the teacher. In addition, this provides opportunities for schools to develop local community partnerships that help to build collective capabilities in providing 21st century learning experiences for students (Bolstad et al., 2012). As well as building local connections, authentic partnerships have enabled schools to express their ethos regarding service to the community. In School B's situation, the Catholic ethos; leadership through service to others, is enabled in an authentic way. Tensions, however, do exist amongst teachers and students in School B about what level of impact the project needs to make, which affects the student's personalised choice of project. Having choice and agency has been articulated as one of the important benefits of PBL in both student and teacher responses. The ability of the student to have choice in the theme of the project and the

ownership of the direction it takes, makes the learning experience more satisfying, meaningful, and transformative (Bolstad et al., 2012). A careful balance is needed to support the aspirations of having a community impact without detracting from the student's perception of agency.

Essential to creating opportunities for achieving student success and maintaining project momentum, is to have a strong PBL framework that guides the students through the project process. A modified version of the design thinking framework (Hasso Plattner Institute of Design at Stanford, nd) was used in School A and C as a structure to frame all of the project phases and was useful to help design and develop the project by promoting ideation and iterations. Teachers in School B who were involved in the teacher-facilitated projects, where students choose their own theme for their projects, had developed their own version of an inquiry framework to guide the project phases. It was considered important in all schools to have a consistent model, templates, and assessment rubrics that guide the students and teachers through the process. All schools had assessment rubrics that were used for student self-reflection and reporting purposes. In School B, however, the assessment rubric grade was also linked to a reward system. This seemed to lead to dissatisfaction amongst some students if they felt that there was an inconsistent understanding amongst teachers about how to assess the quality of the project, especially relating to the impact it made on the community.

Monitoring and tracking of students' progress with their projects needs to be carefully managed and teachers find this aspect difficult to manage. There were iterations of processes designed to do this in the case study schools but that presented as an ongoing challenge for most teachers. This could also be related to the teacher to student ratio, which is another structural issue that could be addressed to reduce teacher workload and enable them to monitor students more effectively.

5.6. Summary

This chapter summarises key factors that affect PBL implementation and enactment of PBL in the senior secondary school at the NCEA level. The findings in this research have indicated that PBL can be implemented in New Zealand secondary schools in the NCEA context, provided strong PBL frameworks and connections with the wider community are in place and the school structure and culture supports it. Most teachers and students in the case study schools perceive that there are many potential benefits to be gained from PBL, such as increasing student engagement, developing 21st century skills, and self-directed learning attributes, whilst gaining some NCEA credits in an integrated and authentic context.

The literature generally supports the findings. Most research studies, however, have been conducted in less interdisciplinary settings compared to the case studies in this research. Despite this difference in context, the benefits and challenges outlined in the literature are congruent with the findings in this research. There still continues to be debate regarding the place of disciplinary knowledge and PBL, and challenges exist with PBL implementation especially when implementing PBL into well-established school environments. Alignment of PBL with NCEA standards is also an ongoing challenge. As Survey Teacher 23 from School C articulates, all of these challenges are navigable.

"*Implementation of a projects curriculum will look different in every school, so there will be a range of challenges including staff attitudes and capabilities, management, finding suitable project contexts and others. These are all navigable with good planning and management.*"

The following chapter will make some conclusions, suggest some recommendations for future research, and describe some limitations of the research.

CHAPTER SIX: Final thoughts

"The best way to predict the future is to create it" Peter Drucker (Cohen, 2009)

6.1. Introduction

This chapter concludes the thesis by summarising the main discussion points and the implications of this study for project-based learning (PBL) implementation in the NCEA context in New Zealand secondary schools. It outlines some recommendations for future research, offers some insights regarding the limitations of the study, and concludes with some final thoughts.

6.2. Conclusion

The purpose of this research was to understand how PBL can be implemented in the NCEA context and the benefits and constraints that were associated with this implementation.

This study has shown that PBL can be implemented at the NCEA level in secondary schools in New Zealand and although there are key design features that need to be present in the PBL process in order to maximise its effectiveness of learners, there is no one model that will fit all secondary school contexts. Findings from this research indicate that schools should be cognisant of the design features of effective PBL and contextualise the structure of the implementation of PBL, in a cross-curricular manner that will best suit the school community. It is important to ensure that PBL at the NCEA level does have an authentic purpose beyond the school environment and the projects the students develop need to respond to a real world problem, or issue that they have identified. Implicit in this is that learners need to make connections with external stakeholders or partners as a feature of their projects.

Findings from this research also indicate that by addressing authentic issues the learning is more meaningful and engaging, promoting deeper thinking and more coherent learning. The self-directed capabilities that the learner develops as a result of having autonomy and connectedness with others in PBL, also develops many 21st century skills that are associated with becoming the solution-focused knowledge builders who are needed to innovate and create a preferred future. In the NCEA context, building the capabilities that help develop

the students' life-long learning dispositions as they prepare for life beyond school is important. Most teachers in the case study schools perceive that PBL, as part of the learning programme throughout the junior and senior school, can have a strong influence on developing these capabilities, while allowing senior students to gain NCEA credentialing in an integrated manner.

Findings in this research indicated that PBL in the NCEA context is not without its challenges. NCEA standards are not always easily aligned with projects, nor are teachers always familiar with standards that are outside their area of expertise. Students may not value PBL if they have the mind-set that gaining credits is easier in traditional subjects, and that this has more value to them than the learning process and the development of 21st century skills. This would be resolved, in part, if there were project specific standards that were developed as part of the Review of Achievement Standards process in the current NCEA review. Continued effort needs to be made to firmly establish a shared learning culture in schools that embrace learner-centred strategies, such as PBL. Tensions continue to exist with some educators regarding how effectively cross-curricular PBL can accommodate subject specific disciplinary and epistemological knowledge relating to project themes.

PBL in the NCEA context also has implications for the traditional role of the teacher. Findings in this research have indicated that student motivation is affected by their ability to self-manage or self-direct. In order for students to be given opportunities to develop self-directed or self-regulated capabilities within PBL, teachers must have the mind-set to embrace a learner-centred approach. They need be able to relinquish some control and guide the learning, whilst still managing and monitoring student progress in a differentiated and scaffolded way. Relinquishing control within a high-stakes NCEA assessment environment has risks for teachers. If PBL is to become a feature of the learning programme in the NCEA context, supportive school cultures and adequate provision for differentiated professional learning is essential.

There are also structural implications for schools implementing PBL as it requires flexible timetabling and resourcing of staff in order to facilitate students having access to expertise relating to their projects. Many participants in this

study perceive that PBL is a strategy that should be implemented into New Zealand secondary schools at the NCEA level as it nudges schools towards having a greater future-focused orientation by making changes that enable learning strategies such as PBL to occur. The nature of PBL implementation promotes coherency in learning through a cross-curricular lens and requires structural changes that allow more flexible resourcing of time, spaces, and teachers. It also promotes greater teacher collaboration and causes a rethink of the traditional roles of the teacher and learner.

6.3. Recommendations for future research

While the research does provide some insights into PBL implementation in the NCEA context and the benefits and constraints associated with this implementation, there is ample room for further investigation of this phenomenon, due to the lack of current research that exists in the New Zealand context.

Due to the absence of external providers of professional learning in New Zealand relating to PBL, more research could be done on how to best support teachers to enact PBL in the NCEA context and develop the project management skills that are needed to ensure that PBL successfully meets the established learning goals.

As the PBL model has variations in the way in which it is implemented, there is also very little research on the quantifiable effectiveness of PBL, especially when it is implemented in a cross-curricular manner, in areas such as cognition and critical thinking. There is also no known research data regarding the effectiveness of PBL on the level of achievement in NCEA compared to more traditional subject teaching. Being able to quantify the effectiveness of PBL in developing 21st century skills compared to more traditional learning in siloed subjects, may also help schools to decide whether to implement PBL as part of the learning programme. Research using the modified MSLQ survey, as used in this study, to ascertain the shift in student motivation and self-regulation over a period of time whilst engaging in PBL, may also be useful to show value-added aspects of PBL.

6.4. Limitations

In this research there may be a range of limitations due to the type of methodology that was utilised and the scope of the study.

This research did not set out to investigate the effectiveness of PBL in the NCEA context. Instead, it considered how PBL could be implemented in the NCEA context and used the perspectives of the teachers and students in each case study school to describe the benefits and challenges that may exist as a result of PBL implementation. Using perspectives of people is always contextual at the point in time that the perspectives were acquired. The study took place in the first term of the school year, at the beginning phase of the students' projects, so perspectives on benefits and challenges could change over time. Also, due to the complexities with working with schools that are continuing to operate while the data gathering is occurring, the number of responses obtained in the teacher and student questionnaire may not necessarily reflect all the potential perspectives within the case study. By only sampling Year 12's in Schools B and C, due to logistical constraints, perspectives from other year levels may not be fully represented. During interviews, participants may have not always fully shared their perspectives, despite the careful planning of the interview by the researcher.

It was also difficult to find schools that had an established PBL programme at the NCEA level that had a full secondary school structure rather than a senior high school (only Year 11 to 13 students). Over time, further research in a diverse range of school settings may add further insights regarding PBL implementation.

Every effort was made to ensure that the findings made in the research are valid, and comparable findings have been identified in the literature from outside New Zealand. By using a multiple case study approach, the variability in PBL implementation was addressed and by triangulating the data gained from students and teachers within a case study and then between case studies, this helped to add to the reliability of the findings.

6.5. Final thoughts

Research findings have indicated that PBL can be successfully implemented in the NCEA context and there are potentially considerable benefits in doing so. By offering senior students an opportunity to engage in projects, it may develop 21st century capabilities and self-regulated learning dispositions that better prepare them for life beyond school, helping them to become self-actualised global citizens. It is hoped that the evidence-based findings in this study will help to inform and give some direction to secondary schools that may want to embark on PBL in the NCEA context in the future.

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APPENDICES

Appendix A: School Participant Information Sheet and Consent Form

(N.B The original was supplied on Massey letterhead)

Project-based learning in the NCEA context: the benefits and constraints of cross-curricular implementation of project-based learning in New Zealand secondary schools.

Date: _____

To the Principal and BOT of _____.

Request for permission to conduct research at your school into project-based learning at the NCEA level

Dear _____

My name is Cathy Hamilton and I am a student at Massey University undertaking Master's research into project-based learning at the NCEA level. I have been a secondary school science teacher for a number of years as well as a Pastoral Dean and have a strong interest in developing effective methods for engaging students in authentic project-based learning. Your school has been suggested to me as one that is developing project-based learning at the NCEA level and I am writing to request permission to conduct a M.Ed. research project in your school in Term One in 2019.

Project Description:

The aim of this research project is to investigate how project-based learning (PBL) can be implemented in the NCEA context and the benefits and constraints that may exist regarding PBL implementation at this level. One of the NCEA reviews opportunities is "Creating space at Level 1 for powerful learning", which suggests reducing the credit load at level One to 40 credits, of which 20 of these would be offered as a project.

The implementation of project-based learning in the NCEA context poses some interesting questions for secondary schools as a structure, teachers in terms of pedagogy and students as self-regulated learners. Although there is evidence of project-based learning occurring in NZ secondary schools, particularly at junior secondary school, there are few schools who have implemented this at the NCEA level. This research project aims to increase the wider teaching population's understanding how PBL can be implemented in the NCEA context and the benefits and barriers that might exist in doing so.

Participant Selection:

The project will involve a survey questionnaire to the whole teaching staff and to students who are involved in PBL at the NCEA level to gain a general understanding of attitudes towards PBL. From this questionnaire, four teachers will be invited to participate in a semi-structured interview to gain an in-depth understanding of their experiences with PBL. I would like to interview the

teachers who are currently involved in PBL at the NCEA level and teachers who have used PBL before or are using it currently at a junior level. I would also like to invite eight students who are currently using PBL at the NCEA level, to participate in two focus group interviews consisting of four students in each. Students will be purposively sampled from two categories, high motivation and lower motivation, based on their questionnaire responses on self-described motivation levels in the PBL class. From these categories students will be randomly chosen to form the focus groups. The purpose of the focus group interview is to gain an in-depth understanding of the perceptions the students have towards PBL.

Project Procedures:

As outlined above, the research will be conducted in two phases. In the first phase, the questionnaires survey monkey link will be given via email to the teachers and students. In order to facilitate this I would like to request a suitable time that I could visit the school to give a brief outline of the project to the staff and provide some food. During this initial visit I would like to be able to meet briefly with those teachers who are currently using PBL at the NCEA level so I would be grateful if you could provide me with their name and contact details on the consent form attached. I would be grateful for permission to be granted to liaise with the school secretary to access staff email addresses to send the survey containing information about the project, consent information and the questionnaire about PBL. I would also like to be able to visit the students in class who are currently involved in PBL to explain the project, consent information and the questionnaire. If any students are under 16 years of age, parental consent will be sought.

In phase two the interviews will take place at a time convenient to the school as outlined above. It is anticipated that the individual teacher's interviews and the student focus group interview will take approximately 45 minutes. During this time I will clarify the interview protocol and participation consent. I would also like to access copies of documentation and assessment outlines relevant to PBL to analyse.

Data Management:

The data gained including consent forms, questionnaire data and interview transcripts will be stored separately in in a locked or password protected storage system for a five year period. After this time the material will be destroyed by myself or my supervisors. Participants are able to access the findings of the project by sending me an email. The identities of the school, teachers and students will be protected by use of numeric coding systems. The school's identity will not be revealed by the researcher, however despite all efforts to protect the identity of the school, someone with knowledge of the school's practices may possibly think they can identify the school if they read the thesis. The researcher will also not reveal the teacher interview participants. However if there are only a few teachers using PBL, others in the school may think they can identify them if they read the research findings.

Participant's Rights:

Participants are under no obligation to accept this invitation. If they decide to participate, they have the right to:

- decline to answer any particular question;
- ask any questions about the study at any time during participation;
- provide information on the understanding that their name will not be used unless they give permission to the researcher;
- Completion and return of the questionnaire implies consent. They have the right to decline to answer any particular question;

<u>If they are involved in the interview they additionally have the right to:</u>

- ask for the recorder to be turned off at any time during the interview;
- be given access to a short summary of the project findings when it is concluded.
- withdraw from the study up to the end of April 2019;

Project Contacts

If you have queries about the project please contact me by email at [redacted] or phone [redacted].

Alternatively you can contact my supervisors form the Education Institute at Massey University

- Dr Peter Rawlins, P.Rawlins@massey.ac.nz or 06 356 9099 Ext. 84403
- Dr Brian Tweed, B.Tweed@massey.ac.nz or 06 356 9099 Ext. 84401

Thank-you in advance for the consideration of allowing me to conduct this research at your school. If you would like to participate please complete the consent form attached to this email and scan a copy to the above email address.

Ngā mihi nui

Cathy Hamilton

M.Ed. student

Committee Approval Statement

- *This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application SOA 18/76. If you have any concerns about the conduct of this research, please contact Dr Lesley Batten, Chair, Massey University Human Ethics Committee: Southern A, telephone +64 63569099 x 85094, email humanethicsoutha@massey.ac.nz .*

PARTICIPANT SCHOOL CONSENT FORM

We agree/do not agree (please circle one) that Cathy Hamilton can conduct her Master of Education research, into project-based learning in the NCEA context at our school as outlined in the Participant school request information sheet.

Declaration by Principal (or Chair of the BOT):

I _____ (print full name) hereby consent to take part in this study.

Signature: _____ Date: _____

School: _____

Contact details of the teachers involved in PBL at the NCEA level:

Name:

Email:

Appendix B: Copy of the questions used in the questionnaire that was distributed to teachers via Survey Monkey

1. Gender M/F

2. Position at school:

3. Teaching experience: (Please select one) 1-3 years, 4-10 years, 11+ years

4. Main teaching subject:

5. Please add your email address if you are currently involved in PBL and would like to participate in the individual interviews:

6. Interest in Project-based Learning: (Please select one)

    I have never used Project-based Learning and I am not interested in trying it at NCEA levels

    I have never used Project-based Learning and I am interested in trying it at NCEA levels

    I have used Project-based Learning and I am not interested in using it at NCEA levels

    I have used Project-based Learning and I am interested in using it at NCEA levels

    I am currently using Project-based Learning at NCEA levels

7. The following questions will separately ask for responses relating to teacher attitudes towards PBL using a scale strongly disagree, disagree, neutral, agree, strongly agree

a. Project-based learning is an effective teaching and learning strategy for engaging student interest and motivation

b. Project-based learning is an effective teaching and learning strategy for achieving targeted learning outcomes

c. Project-based learning is a learning strategy that should be used at NCEA levels

d. Project-based learning could be realistically implemented at NCEA levels

e. Project-based learning helps to develop the capabilities that students need to become life-long learners

f. Project-based learning is less effective if implemented in a cross-curricular manner than in single subject domains

8. Open questions:

a. How would you describe Project-based Learning to another teacher who was unfamiliar with the strategy?

b. What might be the benefits of using Project-based Learning at an NCEA level?

c. What might be the challenges in using Project-based Learning at an NCEA level?

Appendix C: Copy of the questions used in the questionnaire that was distributed to students via Survey Monkey

1. Gender – M/F

2. Year level: 11/12/13

3. Please add your email address if you would like to participate in the focus group interviews:

3. Motivation questions

The following questions ask about your motivation for and attitudes towards the project class or learning module where you are using project-based leaning. There are no right or wrong answers, just answer as honestly as possible about how true this statement is of you.
Scale: not true all (1), usually not true (2), sometimes but often not true(3), occasionally true (4), often true (5), usually true (6), very true of you (7).

a. In a class or learning module like this, I prefer subject material that really challenges me so I can learn new things.

b. In a class or learning module like this, I prefer subject material that arouses my curiosity, even if it is difficult to learn.

c. The most satisfying thing for me in this class or learning module is trying to understand the things I am interested in, as thoroughly as possible.

d. It is up to me to be in charge of my own learning.

e. If I try hard enough, then I will understand the main ideas related to my projects.

f. I believe I will receive a good grades in this learning module/ project.

g. I'm confident I can understand the basic ideas presented in this learning module/ project.

h. I'm confident I can understand the most complex ideas in this learning module/ project.

i. I'm confident I can do an excellent job on my projects.

j. I expect to do well in this learning module/ projects.

k. I'm certain I can master the skills I need to be able to do my projects.

The following questions ask about project-based learning that you are using in this class or learning module. Select the response that best fits with how you feel about the following statements (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree scale)

1. I enjoy using project-based learning in this project class or learning module.

2. I am learning skills while designing and carrying out my project that might be useful for me when I leave school.

3. I prefer project-based learning to other ways of learning.

Write sentences to help answer the following questions:

1. How is project-based learning different from other ways of learning that you do in other classes or classes you have been in previously?

2. What are the benefits of project-based learning for you?

3. What challenges are there in carrying out and completing projects?

Appendix D: Teacher semi-structured interviews questions

1. What is your understanding of the main components of a PBL approach?

2. How have you implemented PBL (Impact projects) at the NCEA level? Why would you/did you decide to implement PBL at the NCEA level?

3. What benefits are there in using PBL for you as the teacher?

4. What are the benefits for student learning using a PBL approach?

5. What are the difficulties in using a PBL approach for the students? What are the difficulties in using a PBL approach for you as the teacher?

6. What different strategies or approaches does PBL require compared to your usual teaching approaches?

7. How are/could you assess PBL outcomes? What do you think should be assessed in PBL? Are there new ways of assessing PBL that are not yet available as NCEA standards?

8. What are/ have been the challenges in implementing PBL at an NCEA level and how did you manage these challenges? What could make the implementation easier in order to facilitate a supportive PBL environment?

9. How do you ensure that students learn the necessary disciplinary/ content knowledge and concepts while they are learning through their own projects?

10. Have you received any professional development regarding PBL? What would be useful for you to develop your skills in facilitating PBL in the future?

11. What has the school done to encourage teachers to try the PBL approach at the NCEA level?

12. What advice would you give to schools starting off on the project-based learning journey?

Appendix E: Student semi-structured questions for focus group interviews:

1. If you had to describe what PBL (Impact Projects) is to other students who had not done it before, what would you say?

2. What do you have to do differently with your learning when you are working on your projects compared to other classes that don't do PBL?

3. What do you think you need to be good at in order to be successful at PBL/ Impact Projects?

4. How might doing projects help with your learning and develop skills that you need to support your learning?

5. How is your Impact Project being assessed? How do you know that you are on track with your project in order to get a good grade?

6. What are some of the challenges with PBL for you?

7. What do you think the teacher has to be good at to make PBL work properly / help you with your Impact Projects?

8. Why do you think that other teachers might not choose to do projects in other subjects?

9. What advice would you give other students if they were starting to do an Impact Project for the first time?

10. If you were given a choice about carrying out an Impact Project or not what would you choose and why?

Appendix F: Teacher Participant Information Sheet

(N.B The original was supplied on Massey letterhead)

Project-based learning in the NCEA context: the benefits and constraints of cross-curricular implementation of project-based learning in New Zealand secondary schools.

TEACHER PARTICIPANT INFORMATION SHEET

Researcher introduction:

My name is Cathy Hamilton and I am a student at Massey University undertaking Masters research into project-based learning at the NCEA level. I have been a secondary school science teacher for a number of years as well as a Pastoral Dean and have a strong interest in researching how project-based learning (PBL) can be implemented in the NCEA context and what perspectives teachers and students have regarding PBL. Your school has been suggested to me as one that is developing project-based learning at the NCEA level.

Project Description:

The aim of this research project is to investigate how project-based learning (PBL) can be implemented in the NCEA context and the benefits and constraints that may exist regarding PBL implementation at this level. One of the NCEA reviews opportunities is "Creating space at Level 1 for powerful learning", which suggests reducing the credit load at level One to 40 credits, of which 20 of these would be offered as a project.

The implementation of project-based learning in the NCEA context poses some interesting questions for secondary schools as a structure, teachers in terms of pedagogy and students as self-regulated learners. Although there is evidence of project-based learning occurring in NZ secondary schools, particularly at junior secondary school, there are few schools who have implemented this at the NCEA level. This research project aims to increase the wider teaching population's understanding how PBL can be implemented in the NCEA context and the benefits and barriers that might exist in doing so.

Participant Selection:

The project will involve a survey questionnaire to the whole teaching staff and to students who are involved in PBL at the NCEA level to gain a general understanding of attitudes towards PBL. From this questionnaire, **four** teachers will be invited to participate in a semi-structured interview to gain an in-depth understanding of their experiences with PBL. I would like to interview the teachers who are currently involved in PBL at the NCEA level and teachers who have used PBL before or are using it currently at a junior level. **If you would like to participate in an interview please supply the email address in the space provided in the questionnaire**. I will also be inviting students who are currently using PBL at the NCEA level to participate in two focus group interviews consisting of four students in each. The purpose of the focus group interview is to gain an in-depth understanding of the perceptions the students have towards PBL.

Project Procedures:

As outlined above, the research will be conducted in two phases. In the first phase, the attached questionnaires will be distributed by survey monkey to the teachers (and students) for your completion. If you wish to participate in this research, it is assumed you have given consent if you complete the questionnaire. Your participation is anonymous unless you provide your email address.

In phase two, the four teacher interviews will take place at a time convenient to yourself. It is anticipated that the individual teacher's interviews (and the student focus group interview) will take approximately 45 minutes. During this time I will clarify the interview protocol and participation consent. I would also like to access copies of your unit plans and assessment outlines relevant to PBL to analyse.

Data Management:

The data gained including consent forms, questionnaire data and interview transcripts will be stored separately in in a locked or password protected storage system for a five year period. After this time the material will be destroyed by myself or my supervisors. The identities of the participant school, teachers and students will be protected by use of numeric coding systems. However, if you teach a PBL class and participate in the interviews, if there are not many classes using PBL at your school there may be a chance that others in the school may think they identify you if they read the findings.

Participant's Rights:

You are under no obligation to accept this invitation to participate in the questionnaire. If you decide to participate, you have the right to:

- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- completion and return of the questionnaire implies consent. You have the right to decline to answer any particular question.

Project Contacts

If you have queries about the project please contact me by email at [redacted] or phone [redacted].

Alternatively you can contact my supervisors from the Education Institute at Massey University

- Dr Peter Rawlins, P.Rawlins@massey.ac.nz or 06 356 9099 Ext 84403
- Dr Brian Tweed, B.Tweed@massey.ac.nz or 06 356 9099 Ext. 84401

If you wish to participate in this research project please click on the survey monkey link in the email to access the research questionnaire.

Thank-you in advance for allowing me to conduct this research.

Ngā mihi nui

Cathy Hamilton

M.Ed. student

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application SOA 18/76. If you have any concerns about the conduct of this research, please contact Dr Lesley Batten, Chair, Massey University Human Ethics Committee: Southern A, telephone +64 63569099 x 85094, email humanethicsoutha@massey.ac.nz .

Appendix G: Student Participant Information Sheet

(N.B The original was supplied on Massey letterhead)

Project-based learning in the NCEA context: the benefits and constraints of cross-curricular implementation of project-based learning in New Zealand secondary schools.

STUDENT PARTICIPANT INFORMATION SHEET

Researcher introduction:

My name is Cathy Hamilton and I am a student at Massey University undertaking Masters research into project-based learning at the NCEA level. I have also been a secondary school science teacher for a number of years as well as a Pastoral Dean.

Project Description:

The aim of this research project is to investigate how project-based learning (PBL) can be implemented in the NCEA context and the benefits and barriers that may exist regarding PBL implementation at this level. One of the options that the 2018 NCEA review suggests is that schools might reduce the credits available at Level One (Year 11) to 40 credits, of which 20 of these would be offered as a project.

Although there is evidence of project-based learning occurring in NZ secondary schools, particularly at junior secondary school, there are few schools who have implemented this at the NCEA level. This research project aims to increase the understanding how PBL can be implemented in the NCEA context and how teachers and students feel about how PBL affects learning.

Participant Selection:

The project will involve a survey questionnaire to the whole teaching staff and to students who are involved in PBL at the NCEA level to gain a general understanding of attitudes towards PBL. I will also be inviting eight randomly selected students who are currently using PBL at the NCEA level to participate in two focus group interviews consisting of four students in each. The purpose of the focus group interview is to gain an in-depth understanding of the perceptions you have towards PBL**. If you would like to participate in an interview with three other students please supply the email address in the space provided in the questionnaire.**

Project Procedures:

The research will be conducted in two phases. In the first phase, the attached questionnaires will be distributed by survey monkey for your completion. If you wish to participate in this research, it is assumed you have given consent if you complete the questionnaire. Your participation is anonymous unless you provide your email address.

In phase two, the focus group interviews will take place for a few participants during school time. It is anticipated that the focus group interview will take approximately 45 minutes. During this time I will explain the interview protocol and participation consent.

Data Management:

The data gained including consent forms and questionnaire data and interview transcripts will be stored separately in in a locked or password protected storage system for a five year period. After

this time the material will be destroyed by myself or my supervisors. Your identity will be protected by use of numeric coding systems.

Participant's Rights:

You are under no obligation to accept this invitation. If you decide to participate in the questionnaire, you have the right to:

- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- completion and return of the questionnaire implies consent. You have the right to decline to answer any particular question;
- be given access to a short summary of the project findings when it is concluded by emailing me to request this.

Project Contacts

If you have queries about the project please contact me by email at [redacted].

Alternatively you can contact my supervisors from the Education Institute at Massey University

- Dr Peter Rawlins, P.Rawlins@massey.ac.nz
- Dr Brian Tweed, B.Tweed@massey.ac.nz

If you wish to participate in this research project please click on the survey monkey link in the email to access the research questionnaire.

Thank-you in advance for allowing me to conduct this research.

Ngā mihi nui

Cathy Hamilton

M.Ed. student

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application SOA 18/76. If you have any concerns about the conduct of this research, please contact Dr Lesley Batten, Chair, Massey University Human Ethics Committee: Southern A, telephone +64 63569099 x 85094, email humanethicsoutha@massey.ac.nz .

Appendix H: Teacher Semi-structured Interview Information Sheet and Consent Forms

(N.B The original was supplied on Massey letterhead)

Project-based learning in the NCEA context: the benefits and constraints of cross-curricular implementation of project-based learning in New Zealand secondary schools.

INDIVIDUAL INTERVIEW TEACHER PARTICIPANT INFORMATION SHEET

Thank-you for volunteering to participate in this individual interview. The purpose of the interviews is to gain an in-depth understanding of your experiences of PBL at the NCEA level. The interview will last for approximately 45 minutes and be recorded on the researchers password protected phone. This will then be transcribed and analysed to form themes about PBL in the NCEA context for a Master of Education thesis.

You are under no obligation to participate in the interview. If you decide to participate, you have the right to:

- decline to answer any particular question;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- ask for the recorder to be turned off at any time during the interview;
- ask for the recording to be returned to you or destroyed after it is transcribed;
- be given a copy of the transcript to check for accuracy if requested;
- be given access to a summary of the project findings when it is concluded by emailing me to request this;
- withdraw from the study up to the end of March 2019;
- the data gained from the interview will be stored in a password protected or locked environment for a period of five years after which time it will be destroyed.

Please read the interview consent form and sign in the space provided to indicate your consent for the interview to proceed.

TEACHER PARTICIPANT CONSENT FORM – INDIVIDUAL INTERVIEW

I have read, or have had read to me in my first language, and I understand the Teacher Participant Information Sheet. I have had the details of the study explained to me, any questions I had have been answered to my satisfaction, and I understand that I may ask further questions at any time. I have been given sufficient time to consider whether to participate in this study and I understand participation is voluntary and that I may withdraw from the study at any time.

1. I agree/do not agree to the interview being sound recorded.
2. I wish/do not wish to have my recordings returned to me.
3. I wish/do not wish to edit the transcript
4. I agree to participate in this study under the conditions set out in the Information Sheet.

Declaration by Participant:

I _____[print full name] hereby consent to take part in this study.

Signature: _____ Date: _____

Appendix I: Student Semi-structured Focus Group Interview Information Sheet and Consent Forms

(N.B The original was supplied on Massey letterhead)

Project-based learning in the NCEA context: the benefits and constraints of cross-curricular implementation of project-based learning in New Zealand secondary schools.

STUDENT FOCUS GROUP INTERVIEW INFORMATION SHEET

Thank-you for volunteering to participate in this focus group interview. The purpose of the focus group interviews is to gain an in-depth understanding of your experiences of project-based learning. The focus group interview will last for approximately 45 minutes during school time and be recorded on the researchers password protected phone. What is recorded will then be written down on a document and analysed to form themes about PBL in the NCEA context for a Master of Education thesis.

It is very important that you keep this focus group interview, and what is said within it, confidential to protect the privacy of other students.

You are under no obligation to participate in the focus group interview. If you decide to participate, you have the right to:

- decline to answer any particular question;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give me permission;
- ask for the recorder to be turned off at any time during the focus group interview. During this time the interview will temporarily cease.
- be given access to a summary of the project findings when it is concluded by emailing me to request this;
- withdraw from the study up to the end of March 2019;
- the data gained from the interview will be stored in a password protected or locked environment for a period of five years after which time it will be destroyed.

Please read the focus group interview consent form and sign in the space provided to indicate your consent for the interview to proceed.

FOCUS GROUP STUDENT PARTICIPANT CONSENT FORM

I have read, or have had read to me in my first language, and I understand the Student Participant Information Sheet. I have had the details of the study explained to me, my questions have been answered to my satisfaction, and I understand that I may ask further questions at any time. I have been given sufficient time to consider whether to participate in this study and I understand participation is voluntary and that I may withdraw from the study at any time.

1. I understand that I have an obligation to respect the privacy of the other members of the group by not disclosing any personal information that they share during our discussion.
2. I understand that all the information I provide will be kept confidential to the extent permitted by law, and the names of all people in the study will be kept confidential by the researcher.

Note: There are limits on confidentiality as there are no formal sanctions on other group participants from disclosing your involvement, identity or what you say to others in the focus group. There are risks in taking part in focus group research and taking part assumes that you are willing to assume those risks.

3. I agree to participate in the focus group under the conditions set out in the Information Sheet.

Declaration by Participant:

I _____[print full name] hereby consent to take part in this study.

Signature: _____ Date: _____

Appendix J: Under 16 Whānau Information Sheet and Consent Form

(N.B The original was supplied on Massey letterhead)

Project-based learning in the NCEA context: the benefits and constraints of cross-curricular implementation of project-based learning in New Zealand secondary schools.

Introduction to parents/caregivers/whanau

Researcher introduction:

My name is Cathy Hamilton and I am a student at Massey University undertaking Masters Research into project-based learning at the NCEA level. I have also been a secondary school science teacher for a number of years as well as a Pastoral Dean. I am sending this to you to let you know about the research that I am conducting at _____ from the _____ 2019.

Project Description:

The aim of this research project is to investigate how project-based learning (PBL) can be implemented in the NCEA context and the benefits and barriers that may exist with PBL implementation at this level. This research project aims to increase the understanding how PBL can be implemented in the NCEA context and how teachers and students feel about how PBL affects learning.

Participant Selection:

The project will involve a survey questionnaire given to students who are involved in PBL at the NCEA level, to gain a general understanding of attitudes towards PBL. I will also be inviting eight, randomly selected students, who are currently using PBL at the NCEA level, to participate in two focus group interviews consisting of four students in each. The purpose of the focus group interview is to gain an in-depth understanding of the perceptions they have towards PBL**.**

Participant's privacy:

The data gained, including consent forms, questionnaire data and interview transcripts, will be stored separately in in a locked or password protected storage system for a five year period. After this time the material will be destroyed by myself or my supervisors. Student identity will be protected by use of numeric coding systems so students will not be individually identified. Students will also have the right to ask questions about the study at any time during participation and decline to answer any question if they do not feel comfortable in doing so. Students can be given access to a short summary of the project findings when it is concluded by emailing me to request this.

Project Contacts

If you have queries about the project please contact me by email at [redacted].

Alternatively you can contact my supervisors from the Education Institute at Massey University

- Dr Peter Rawlins, P.Rawlins@massey.ac.nz
- Dr Brian Tweed, B.Tweed@massey.ac.nz

Thank-you in advance for your consideration in allowing me to conduct this research with your family member. If he or she is under 16 could you please fill in the consent form and return it to the Future Focus teacher. Otherwise, please email me if have any concerns.

Ngā mihi nui

Cathy Hamilton

M.Ed. student

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application SOA 18/76. If you have any concerns about the conduct of this research, please contact Dr Lesley Batten, Chair, Massey University Human Ethics Committee: Southern A, telephone +64 63569099 x 85094, email humanethicsoutha@massey.ac.nz .

Parental/Caregiver consent form for students under 16 years of age:

Declaration by parent/caregiver:

I _____give permission for _____ (name of child)

to take part in this project-based learning research.

Signature _____ Date: _____

Relationship to the student: _____

Appendix K: Massey University Human Ethics Approval Letter

Date: 03 December 2018

Dear Catherine Hamilton

Re: Ethics Notification - SOA 18/78 - New Application
Project-based learning in the NCEA environment: the affordances and constraints of cross-curricular implementation of project-based learning in New Zealand secondary schools.

Thank you for the above application that was considered by the Massey University Human Ethics

Approval is for three years. If this project has not been completed within three years from the date of this letter, reapproval must be requested.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee.

Yours sincerely

Professor Craig Johnson
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

Research Ethics Office, Research and Enterprise
Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand T 06 350 5573; 06 350 5575 F 06 355 7973
E humanethics@massey.ac.nz W http://humanethics.massey.ac.nz

Appendix L: Example of Coding from Case Study One using Nvivo

Case Study A Teacher Themes Nodes for Benefits of PBL for the learner

Subtheme/node names	Number of References	Illustrative quotes
Benefits of PBL to the learner		
Authentic learning- Develops skills and knowledge with a real life context	14	*"It also helps students understand how learning happens in real life; you find and learn the knowledge that is relevant for the particular problems that arise in their project."* Survey Teacher 19
Coherency and transfer in learning	1	*"Students are more motivated and are able to make links in a number of subjects and Achievement Standards. They start to see greater connections between curriculum areas."* Survey Teacher 7
Collaborating with stakeholders	4	*"We're thinking a lot of the collaboration, not all maybe come through class, but people outside in the community as well like the stakeholders."* Interview Teacher C
Deep learning	7	*"Can promote learning in depth and breadth."* Survey Teacher 23
Develop 21st century skills	13	*"I mean we are developing all these great employability skills."* Interview Teacher D
Develops student agency and self -management	9	*"The ability to manage time and set goals would be the two big impacts on learning."* Interview Teacher D
Increased engagement or motivation towards learning	20	*"Greater engagement from students. Better outcomes."* Survey Teacher 9
Gaining NCEA credits	4	*"Last year in in Yr 11 a lot of our students were getting excellences for Level 2 English in Yr 11 purely because when they focussed on using their project as their context for formal writing or oral text and things like that, they were all over it, it was easy for them.*" Interview Teacher A
Learning focus rather than NCEA credentialing focus	4	*"It may help to prevent the 'credit counting' attitude that manifests in senior students."* Survey Teacher 5
Personalised learning and choice	7	*"Personalisation of learning." Survey Teacher15*
Reduced workload	1	*"Learning can be used across different subjects for assessments reducing workload for students*." Survey Teacher 26

Appendix M: Merged Themes using a modified version of Stakes(2006) Worksheet 5A

Chart showing the importance of the findings within each theme, for each case study school. Importance was rated using the frequency of the responses in the questionnaires open questions and interview data.

Themes	Findings	School A		School B		School C	
		T	S	T	S	T	S
a. Enablers of effective enactment of PBL in the NCEA context – characteristics of PBL and the role of the teacher	Cross-curricular learning	4	4	3	NA	4	NA
	External partnerships/ stakeholders collaboration	4	4	4	2	4	4
	Problem solving or project outcome has an impact on the community	4	4	4	1	4	4
	Design thinking framework	4	NA	1	NA	4	NA
	Templates guiding students through project phases	2	4	2	2	4	4
	Use of assessment rubrics to give feedback	2	2	4	1	4	4
	Self- directed, learner-centred, authentic learning experiences with students producing an outcome in response to a real world issue or need	4	4	4	4	4	4
	Students have true agency in terms of project focus and approach	4	4	1	4	3	3
	NCEA standards aligning to projects	4	4	2	1	3	3
	Uses interest or passion of the learner	4	4	4	4	4	4
	Learning driven by learning goals rather than assessment	4	NA	4	NA	4	NA
	Deeper learning through extended time periods	4	4	4		4	
	Teacher facilitates, guides, mentors and coaches rather than directing students during projects	4	4	4	4	4	4
	Teacher has enthusiasm for projects	4	4	NA	NA	4	4
	Teacher manages accountability and progress in projects giving scaffolded assistance when needed	4	4	4	4	4	4
b. Benefits of PBL to learners	Increases engagement or motivation towards learning due to personalised choice and interest in the project	4	4	4	4	4	4
	Develops 21st century skills (“soft skills”) needed for the future	4	4	4	4	4	4
	Develops student agency and self-management abilities	4	4	4	2	4	4
	Authentic learning contexts develops knowledge and skills that allow deeper learning and more coherency	4	NA	4	NA	4	NA
	Development of communication and collaboration skills through interacting with stakeholders and external partners	4	4	3	2	4	4
	Authentic, meaningful learning leading to NCEA credentialing reducing workload and credit hunting mentality	4	4	2	2	4	4
	Developing connections with the wider community and empathy for others and being empowered to make a difference	4	4	4	2	4	4

	Having the opportunity for having learning experiences that students might not normally be exposed to	NA	NA	3	4	NA	NA
c. Barriers to student success using PBL	Level of self-management ability has an effect on success and motivation in PBL	4	4	4	4	4	4
	Lack of access to specialist teachers and learning spaces	3	4	NA	2	NA	NA
	Difficulties scoping a project and navigating the path forwards	2	3	NA	NA	NA	NA
	Difficulties connecting with stake holders/partners	3	4	NA	NA	3	4
	Inconsistent teacher ideas about the level of impact required in the community	NA	NA	3	4	NA	NA
	Inconsistent teacher use of templates or project framework	2	4	2	4		
	The need to gain NCEA credits compromises the value given to PBL and the time and innovation students are willing to give to the project	1	1	4	4	1	NA
	The need to gain NCEA credits from projects increases anxiety	4	4	NA	NA	NA	NA
	Project fatigue	NA	NA	4	4	NA	NA
	Project group dynamics	NA	NA	NA	NA	2	2
	Project allocated time limiting ability to take other subjects	NA	NA	2	4	NA	NA
	Maintaining momentum when teacher support insufficient or unavailable	2	2	2	2	2	2
	Time restrictions limiting progress	NA	NA	NA	NA	2	2
d. Challenges or barriers to implementation of PBL	The impact of NCEA and UE imperative including credits needed for each Level, difficulties aligning assessment standards to projects, external moderation	4	NA	4	NA	4	NA
	School structural impacts such as timetabling, resourcing, staffing and siloed subject areas, workload issues	4	NA	4	NA	3	N
	Teacher attitudes towards PBL including mind-sets and concerns about disciplinary knowledge needed for NCEA	4	NA	4	NA	3	NA
	Decreased teacher capabilities including project management skills, understanding about PBL, awareness of NCEA standards outside expertise area, change in role	4	NA	4	NA	3	NA
	Lack of relevant professional learning about PBL in the NZ context	4	NA	4	NA	1	NA
	Difficulties monitoring and managing students – systems and capabilities	4	NA	4	NA	3	NA
	Lack of shared philosophy and vision about PBL pedagogy	2	NA	4	NA	1	NA
	Whānau not engaged in the PBL process and value NCEA credentialing over other learning benefits	4	NA	4	NA	1	NA
	Project specific NCEA standards developed	4	NA	4	NA	4	NA

e. Future development of PBL	Existing standards and moderators become more open to alternative assessment formats and acknowledgement of group work	4	NA	NA	NA	4	NA
	Structural changes in the school to increase flexibility and efficacy of PBL implementation	4	NA	4	NA	NA	NA

Importance ratings are on a scale from 4= very highly important, 3= High importance, 2 =Medium importance, 1 = low importance, NA = Not applicable is if the finding is not articulated in the data. Teacher perception =T, Student perceptions = S (where applicable)