

Integration of Emerging Educational Technologies by Teachers of Students who are Deaf or Hard of Hearing in New Zealand

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A thesis submitted in fulfilment of the requirements for the
degree of Doctor of Philosophy in Education

University of Newcastle, New South Wales, Australia

September 2020

This research was supported by an Australian Government Research Training
Program (RTP) Scholarship

Statement of Originality

I hereby certify that the work embodied in the thesis is my own work, conducted under normal supervision. The thesis contains no material which has been accepted, or is being examined, for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made. I give consent to the final version of my thesis being made available worldwide when deposited in the University's Digital Repository, subject to the provisions of the Copyright Act 1968 and any approved embargo.

Hilda Anna Engelina Baker

Dedication

This work is dedicated to past, current and future students who are deaf or hard of hearing and all those involved with their language development, learning progression and social growth.

Acknowledgements

Ehara taku i te takitahi engari, he toa takitini: Our strength does not come from ourselves alone. Our strength derives from many. (New Zealand Ministry of Education, 2017g. p.12)

I wish to acknowledge the Australian Government for the study grant to pursue the Higher Research Degree. My sincere thanks go to my primary supervisor Doctor Scott Imig, and co-supervisors, Professor John Fischetti and Doctor Jill Duncan. I valued their expertise and guidance through each stage of the study in making my research such a rewarding learning experience. Also, I am grateful for the input from the academic, professional, library, administrative and editing staff of the University of Newcastle.

I thank the New Zealand Ministry of Education for granting me a year of study leave to pursue my research; the 2017 Combined Board of Trustees of the two deaf education centres; and those teachers who willingly gave their time to participate in the two research instruments. I am especially grateful to the students and their teachers, who were the inspiration for this research.

I wish to extend my sincerest thanks to my husband for his sustained backing of my studies, immediate and extended family, close friends, acquaintances, and people along the way who encouraged me with good wishes, fresh insights and new perspectives.

It is my desire for this research to assist the education of students who are deaf or hard of hearing as, amongst others, we embrace emerging educational technologies to meet the challenges of today, and prepare and look forward to the future.

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Abstract

New Zealand teachers of students who are deaf or hard of hearing (DHH) integrate emerging educational technologies (EET) in their pedagogy in varying ways. There is limited research related to the unique influence of incorporating these technologies into the curriculum to support student-centred inquiry, communication, and social growth for students who are DHH. This explanatory research had a fourfold purpose. First to examine how New Zealand teachers of these students integrate EET into teaching; second, to ascertain the challenges of integrating EET in teaching; third, to identify the teachers' perspective on the significance of school leadership when integrating EET in pedagogy and; fourth, to consider the element of theoretical frameworks that underpin the practice of integrating EET into student-centred inquiry when teaching students who are DHH. The research used mixed methods for the analysis of both quantitative and qualitative data. The data analysis resulted in five recommendations and five proposals for fields of further research. The data findings - on grounding the practice of EET integration in teachers' pedagogy of students who are DHH into a framework, such as the Technological, Pedagogical and Content Knowledge (TPACK) model - concluded the requisite of four additional contexts and an expanded one. These contexts are access to language and information, lifelong learning, the importance of leadership, and the recognition of rapid change and developments in technologies for education. The expanded context adds lifelong learning to the context of teacher training.

Key terms: Deaf or hard of hearing (DHH), emerging educational technologies (EET), pedagogy, student-centred inquiry, teachers of students who are DHH.

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Acronyms

Apps - Application downloaded by a user to a mobile device

DHH - Deaf or hard of hearing

EET - Emerging educational technologies (plural)

IEP - Individual education plan

RAT – Replace, Amplify, Transform (model)

SAMAR – Substitution, Augmentation, Modification, Redefinition (model)

SMART - Specific, measurable, attainable, relevant, time-based

TPACK - Technological, pedagogical and content knowledge

Glossary of Maori words

ako - child

akonga - students

Aotearoa - New Zealand

hapu - tribes

he tangata - people

iwi - people

ka hikitia - managing for success

kaiako - teachers

kura - school

kura kaupapa - a primary school that teaches Māori values through Māori language as the medium of instruction

mahi - work

mahi ngātahi - collaborative practices

mahi tahi - unity in working together in practical ways as a group towards a specific goal or the implementation of a task

manaakitanga - the responsibility and authority of the adult to care for the child's emotional, spiritual, physical and mental well-being

poari - board of trustees

taha hinengaro - mental and emotional

taha whānau - family relational and social wellness

tamariki - children

tangata whenuatanga - affirms Māori learners as Māori by providing and affirming the contexts for learning, language, identity and culture

taha tinana - physical

taha wairua - spiritual

tātaiako - cultural competencies for teachers of Māori learners

te kanohi mataara – leadership

Te Kura Tātari Reo - School of Linguistics and Applied Languages Studies

te reo Māori - Māori language

te reo Māori me ōna tikanga - Māori language and its cultural practices

Te Tiriti o Waitangi - Treaty of Waitangi

Te Whare Whā - the house with four walls (well-being model)

wānanga - participating with students and communities in robust dialogue for the benefit of Māori learners' achievement

whanake ngaiotanga - professional learning

whānau - family

whanaungatanga - making connections and relating to people in culturally appropriate ways, through past heritages, points of engagement, or other relationships

whenua - roots

(Education Review Office, 2016d; New Zealand Ministry of Education, 2011b).

Key Terms

My research occurred in deaf education in New Zealand/Aotearoa, where there are two deaf education centres – one in the North Island and one in the South Island. The centres are public sector Crown entities of the New Zealand Ministry of Education, governed by one board of trustees/poari. I included some te reo Māori (Māori language) terms, which occur in everyday speech and professional contexts in New Zealand. I thus acknowledge the cultural diversity and three official languages (English, Māori and New Zealand Sign Language). I explain five key terms relating to the scope of this study on integrating emerging educational technologies (EET) in the education of students who are deaf or hard of hearing (DHH). The key terms are DHH, teachers/kaiako of students/akonga who are DHH, EET, pedagogy, and student-centred inquiry.

Deaf or Hard of Hearing (DHH)

There are both medical and socially constructed definitions for the condition of DHH (Kermit, 2009). The circumstances under which individuals develop hearing loss affect how they experience sound, communicate with others and view this loss (New Zealand Ministry of Education, 2016, 2018f). Hearing loss causes developmental delays in receptive and expressive speech, language communication skills and literacy (Thagard, Hilsmer & Easterbrooks, 2011). These barrier cause learning problems, gaps in world knowledge, lack of learning strategies, and reduced academic achievement (Easterbrooks et al., 2015; Marshall et al., 2018; Mouny, Pucci, & Harmon, 2013). Communication difficulties may lead to social isolation, poor self-concept and affect identity and social growth (Brice & Strauss, 2016; Netten et al., 2015; Rieffe, 2012). Additionally, hearing loss may impact vocational choices (Nagel, Newman, Shaver & Marschark, 2016).

The development of age-appropriate expressive and receptive communication and language and literacy skills are, therefore, fundamental to the child's cognitive, academic

and social progress, as well as their mental and physical well-being (Ching, Dillon, Leigh, & Cupples, 2018; Coll, Cutler, Haas, & Powell, 2009; Lederberg, Schick, & Spencer, 2012). Thus, early identification and support of hearing loss are crucial to establishing appropriate language and educational development (Ching et al., 2018; Gibbons, 2015; Martin-Prudent, Lartz, Borders, & Meehan, 2016). Teachers incorporate diverse adjustments and options to meet these students language, learning, emotional and social needs (Guardino & Cannon, 2016; Marschark, Shaver, Nagle & Newman, 2015).

Language for communication in the hearing loss spectrum ranges from sign language to spoken language access through assistive hearing devices, including cochlear implants (Hall, Hall, & Caselli, 2019; Vermeulen, De Raeve, Langereis, & Snik, 2012). When learning to read, some students use sign supported English to read words that do not have a sign, such as articles to define nouns (Maltby, 2016; Marshall & Hobsbaum, 2015). The spectrum also includes those who have an additional condition, over and above their deafness, which affects them medically, physically, emotionally or socially (Bruce, Di Natale, & Ford, 2008; King, 2013; Musyoka, Gentry, & Meek, 2017).

People who are DHH express their social identification with the DHH world, or with family/whānau heritage cultures, or with both (New Zealand Ministry of Education, 2013b; Te Wiata, 2016). Deaf people may see themselves as an ethnolinguistic minority culture for whom the primary source of information is through vision (Hauser, O'Hern, McKee, Steider, & Thew, 2010; Scheetz, 2012). Those people who embrace and affiliate with the long history, language, cultural norms, beliefs, values, identity and membership of the Deaf community identify with the spelling of Deaf with a capital D (Hamil & Stein, 2011). Although mindful of the distinction between Deaf and deaf, I selected not to capitalise deaf in my research because of my inquiry's generic nature.

Teachers/Kaiako of Students/Akonga who are DHH

The work/mahi of teachers/kaiako of students/akonga who are DHH provides specialist-teaching knowledge to their students. In New Zealand, these fully registered teachers, known as teachers of the deaf, hold the compulsory two-year part-time postgraduate diploma (Postgraduate Diploma in Specialist Teaching (DHH)). The training is grounded in an inquiry-based model and focusses on understanding the learning needs and development of students who are DHH. It includes gaining proficiency in New Zealand Sign Language (NZSL), listening and spoken language practices (Massey University, 2021). These teachers follow the New Zealand Teaching Council's practising teacher criteria (New Zealand Teaching Council, 2019a, 2019b) and the New Zealand school curriculum didactics (New Zealand Ministry of Education, 2007b). The Education Review Office (ERO) reports on the education quality, compliance, and expenditure (Education Review Office, 2016a, 2016c, 2019).

Teachers of students who are DHH either teach their students in a provision at mainstream schools or itinerate to work alongside mainstream school staff who have a student who is DHH attending a school in the local community (Bullard & Luckner, 2013). In both instances, teachers consult with the mainstream teachers and specialist service providers to establish collaborative practices to support, extend and enrich the language development, learning progression and social growth of these children/tamariki (Ayantoye & Luckner, 2016; Compton, Appenzeller, Kemmery, & Gardiner-Walsh, 2015). These teachers' competencies include knowledge of the English language, New Zealand Sign Language, deaf culture, auditory processing, speech development, and understanding assistive hearing technologies' applications (Easterbrooks, 2008).

As good teaching is not dependent on or limited to the teacher's hearing status, teachers can be hearing, hard of hearing or deaf (Robertson & Serwatka, 2000). Further,

there does not appear to be differences in students' attitude toward deaf or hearing teachers. However, deaf students are likely to show a higher preference for deaf teachers, which is not necessarily true for hard of hearing students (Robertson & Serwatka, 2000). Teachers recognise the effects and complex interplay of the many factors of deafness on their students' development. They, therefore, direct and adapt their pedagogy towards language acquisition for access to knowledge and information, equity, inclusion and competence in communication, learning and social engagement (Garberoglio, Gobble, & Cawthon, Winton, Garberoglio & Gobble, 2011; Luft, 2017; Marschark, Shaver, Nagle, & Newman, 2015). Most importantly, these teachers employ strategies to involve parents and families/whānau in their child's education (Foster & Cue, 2009; Davidson-Mowle, Leigh, Duncan, & Arthur-Kelly, 2018; New Zealand Ministry of Education, 2019b).

Teachers of students who are DHH are resource orientated and consider the innovations of EET integration to expand their students' learning (New Zealand Ministry of Education, 2018a). EET allow opportunities to access visual images such as pictures, icons, photos and videos for rich language, learning and social experiences in teaching (Berent, Kelly, Schmitz, & Kenney, 2008; Dye, Hauser, & Bavelier, 2008). While Marschark et al. (2017) challenged the assumption that all deaf students are visual learners, Knoors and Marschark (2014, 2015) believed that visual presentation of information to clarify context is an educational cornerstone in the teaching of students who are DHH. They concluded that great strides for the future education of students who are DHH could result from informed, objective evidence. Knoors and Marschark's view (2014, 2015) was the pervading view among the teachers at the time of my study.

Emerging Educational Technologies (EET)

The term 'emerging educational technologies' (EET) presents challenges regarding what they are, what they offer for education, what they mean for the teachers,

students and schools, and when an item of technology ceases to be new or emerging.

Also, EET are not always abundantly researched as they have not matured fully.

Veletsianos (2010) defines EET as tools, innovations, and advancements used in varied educational settings, such as distance or in-person teaching, to serve educational goals such as learning, social development, and organisational functions.

For my thesis, I define EET as those technologies that teachers integrate into their pedagogy to bring about new teaching methods. The EET they use may not necessarily be emerging (such as laptops). However, laptops accommodate increases in resolution, performance and contemporary developments such as innovative software programs and applications, which teachers skilfully include to enable engaging teaching methods and learning experiences. Hence they are included as EET in this research. Laptops at school are increasingly supplemented with other mobile devices such as i-pads and mobile phones. The innovations of EET focus on connectivity, versatility, and student-centred inquiry to make teaching more effective in delivering knowledge, building better teaching and learning experiences that result in higher learning outcomes. Many websites describe the most recent annual trends in EET (CORE Education 2017c; New Media Consortium, 2017). My research focussed on eight educational technologies as emerging. These are portable digital devices with their software and apps, broadband for streaming, digital games, augmented reality, artificial intelligence, virtual reality, robotics and data analysis software.

Characteristics of EET include rapid growth, constant flux, and evolution through change, refinement and development (Halaweh, 2013; Veletsianos, 2010, 2016). These technologies are future-directed (NZTech, 2016), provide radical novelty and have a noticeable impact as disrupters and game-changers (Consortium for School Networking, 2019; Rotolo, Hicks, & Martin, 2015). They provide digital solutions to supplement,

support, enhance, extend and enrich student-centred inquiry and communication (Granshaw, 2015; Kong et al., 2014; Zagami, 2015). Their use may motivate students' higher-order cognitive skills for critical thinking and reflection (Barber & King, 2016; Churches, 2008; Crook & Sharma, 2013).

EET technologies may encourage social growth, behaviour and collaborative skills (Caica, 2011; Scherer, Siddiq, & Teo, 2015). Embracing collaboration is increasingly necessary for awareness of social perspective-taking, understanding others, and comprehending fellow students' values and perspectives (Ioannou & Constantinou, 2018). Further, EET support computational skills and competencies for participating and thriving in a contemporary and evolving society (Johnson, Maquire, & Wood, 2017; New Zealand Ministry of Education, 2018a). These technologies create new possibilities in special education as they have the potential to augment learning, provide equity and inclusion, and compensate for special, physical and sensory learning needs (Edyburn, 2013; Guerriero, 2013; New Zealand Ministry of Education, 2016).

In New Zealand, the practice of supporting learning through EET is named e-learning (New Zealand Ministry of Education, 2019a). EET function as valued resources and connectors for New Zealand's two deaf education centres by providing teachers with tools to support, motivate and extend their students' access and equity to language, learning and social growth (Bolstad et al., 2012; Combined Board of Trustees, 2019).

Pedagogy

Watkins and Mortimer (1999) defined pedagogy as "any conscious activity by one person designed to enhance learning in another" (p.3). Elements of pedagogy first consider how teachers interact with their students (Watkins & Mortimer, 1999). A second element concerns the learning context, social and intellectual environment teachers seek to establish for successful student participation, engagement, and learning achievement

(Bishop & Starkey, 2006; Watkins & Mortimer, 1999). The third element encompasses theories and concepts of learning and understanding students' backgrounds, interests and individual needs (Brownell, Benedict, & Leko, 2019; New Zealand Ministry of Education, 2007b; Watkins & Mortimer, 1999). Theories and concepts of learning permit teachers to understand how students construct and acquire skills and develop positive attitudes to learning (New Zealand Ministry of Education, 2007b). Evidence-based practices, assessment, collaborative work, discussion, experts' advice, the reflection of teaching, and research on promising applications all inform pedagogical decisions (Donohoo & Velasco, 2016; Hattie, 2015; New Zealand Ministry of Education, 2019b).

New Zealand teachers base their pedagogy on student-centred inquiry learning and support the Maori pedagogical view of higher congruency between the home and school culture (New Zealand Ministry of Education, 2018d; Stucki, 2012). Another essential consideration in New Zealand teachers' pedagogy is equitable access to education, resources, and inclusion in learning activities to develop the students' independence (Powell, 2012). Therefore, pedagogy in the education of students who are DHH focusses on the professional skills and practices of effective teaching to transmit knowledge relating to language development, learning progression and social growth (Cannon & Guardino, 2012; Lederberg et al., 2012; Scott & Dostal, 2019). Teachers' integration of EET for learning and teaching may encourage their students' educational development (Champaigne, 2013; Loveless, 2010, 2011; Mishra & Koehler, 2006).

Student-centred Inquiry

Student-centred inquiry includes familiarisation, hypothesising, exploring, explaining, revising and reporting on the learning goals, activities, results and assessment (Arnett, 2020a; Jansen, 2011; Pizzo & Chilvers, 2016). It has interrelated phases to secure the students' interest and build a knowledge base by posing questions, finding

resources, interpreting information and reporting findings (Balim, 2009; Christensen, Horn, & Staker, 2013; Maniotes & Kulthau, 2014). Student-centred inquiry enhances personal growth, knowledge, skills, competencies, capabilities, autonomy and self-regulation skills for lifelong learning and problem-solving (Mascolo, 2009; New Zealand Ministry of Education, 2007b). Some research reports that teachers may hold both teacher-centred and student-centred pedagogical beliefs (Tondeur, van Braak, Ertmer, & Ottenbreit-Leftwich, 2016). Teachers increasingly integrate EET for student-centred inquiry (Akkoyunlu & Soyulu, 2008; Antoniou & Ionnou, 2018; Costley, 2014) as it accommodates the discovery of new knowledge and skills through digital solutions to real-world problems (Ananiado & Claro, 2009; Froyd & Simpson, 2008).

Student-centred inquiry in the education of students who are DHH develops and expands their language use (Cannon & Guardino, 2012; Marschark & Knoors, 2012; Marschark & Wauters, 2008); creates positive learning attitudes, increases knowledge retention, improves in-depth contextual understanding, and inspires collaborative learning (Baeten, Kyndt, Struyven, & Dochy, 2010; Jeong & Hmelo-Silver, 2016); encourages motivation, curiosity, and the construction of meaning through investigation and discovery (Attard, Di Ioio, Geven, & Santa, 2010; McLellan, 2008; Tangney, 2014); accommodates peer collaboration and problem-solving through shared learning experiences (Brown, Dennis, & Venkatesh, 2010; Le, Janssen, & Wubbels, 2018; New Zealand Ministry of Education, 2017f); encourages independence, extension and enrichment of learning (Chegenizadeh, Nikraz, & Zadeh, 2012; New Zealand Ministry of Education, 2007b); brings students' ideas and concepts to the learning experiences; and increases their choice, the flexibility of time, location, place, study content, and active construction of knowledge (Sparrow, Sparrow, & Swan, 2000).

Chapter One: Introduction

Ko te tamaiti te Putake o te kaupapa: The child - the heart of the matter.

(Education Review Office, 2015a. p.i)

In this thesis I investigate the integration of emerging educational technologies (EET) by teachers of students who are deaf or hard of hearing (DHH) in New Zealand. This explanatory research aims to support the gap in the literature on this field and contribute to the education of students who are DHH. In this chapter, I present my research background. After introducing the problem statement concerning the dearth of research on this topic as a situation worthy of investigation and contributing to the limited existing literature, I put forward my study's purpose. Next, I present my four research questions and state the rationale and significance of this research. I present eight contexts relating to the integration of EET by teachers of students who are DHH and develop these in-depth in the following five chapters of the thesis. I discuss the need for a theoretical framework to base EET teaching practices and refer to the Technological Pedagogical Content Knowledge (TPACK) framework (Koehler & Mishra, 2005, 2009; Mishra & Koehler, 2009b). I then clarify my role as the researcher and the lead position of acquiring learning resources I held at the centre where I worked at the time of this study. I thus explain my interest in leadership as it plays a critical role in policies and practices to support EET application in teaching. Finally, I present the organisation of this thesis into six chapters.

Background

I grounded my research on elements of a constructivist and transformative worldview, implemented through student-centred inquiry (Attard, Di Ioio, Geven, &

Santa, 2010; McIellan, 2008; Tangney, 2014). From the constructivist worldview, I accepted the multiple realities and perspectives that researchers and research participants bring to integrating emerging educational technologies (EET) in teachers' pedagogy. I also realised the benefits and challenges of a relationship of closeness, subjectivity and bias due to working on the same site as the research participants when building on data interpretation. From a transformative worldview, I recognised the multifaceted aspects of different cultures and positions, the call for collaboration and participation in an environment of active involvement and trust, human rights and social justice for all and advocacy for the education of students who are DHH (Creswell & Plano Clarke, 2018).

My literature investigation, the study of the New Zealand Curriculum and reflection on teaching practices that integrate EET prepared me for contributing to the literature gap and limited empirical evidence in this field. This section expands on three actions for my research background and the methodology discussed in Chapter 3. These three activities were literature investigation, reflection on teachers' integration of emerging educational technologies (EET) and scrutiny of the New Zealand curriculum.

Investigation of literature.

My literature investigation into why teachers choose to integrate EET in their pedagogy revealed that over time, they had integrated numerous resources, theoretical constructs and leveraged digital technology innovations - such as hardware, software, apps and the Internet - into their pedagogy (Aldunate & Nussbaum, 2013; Claro et al., 2018; Jimoyiannis, Tsiotakis, Roussinos, & Siorenta, 2013). When EET integrate well into pedagogy, it empowers learning relationships that reflect the aspirations of students (New Zealand Ministry of Education, 2020). Further, it strengthened collaborative inquiry, built on students' year levels, and provided learning at varied locations (Genlott and Grönlund, 2016). Teachers, therefore, included these innovations in ways to prepare

their students for lifelong, creative learning and problem-solving so that they might contribute to a globally interdependent and connected world (Germaine, Richards, Koeller, & Schubert-Irastorza, 2016; Roblyer & Doering, 2014; Veletsianos, 2016).

In the post-secondary context of deaf education, research at Rochester Institute of Technology (National Technology Institute for the Deaf Centre) seeks to develop accessible solutions to the ubiquitous use of technologies and the widespread accelerated implementation of best practices regarding the integration of EET. The institute investigates, evaluates, and reports on the most effective and efficient means to bring digital technologies and students who are DHH together. Further, it collaborates with other universities, industries, and professional organisations to promote research of technologies that positively impact the post-secondary educational access and experiences of students who are DHH (Rochester Institute of Technology, 2021).

In summary, the opportunities and benefits of integrating EET in pedagogy appear to be that these enlarge the students' educational options, increase their cognitive and academic skills and enrich their lives both in the present and for the future (Heitink, Voogt, Fisser, Verplanken & van Braak, 2017; Mumtaz, 2000; Nikolarazi, Vekiri & Easterbrooks, 2013). These technologies seem to offer innovative and engaged learning (Ferguson, 2009; Johnson et al., 2017; Ramoroka & Sebola, 2017). Also, EET appear to provide teaching avenues to develop the students' cognitive and complex thinking, in-depth understanding, insights and ability to find solutions (Bonfiglio-Pavisich, 2018; Fullan & Langworthy, 2013; Hartmann & Weismer, 2016).

Reflection.

During my teaching and management, I observed teachers' purposeful integration of EET to enhance their students' communication, language development, learning progression and social growth (Education Review Office, 2016d; Garner, 2010; Woolfolk

& Margetts, 2010). Purpose appeared to be essential for the effective integration of EET to support, extend and enrich learning (Bollinger, Inan, & Wasilik, 2014; Capuano, Tagarelli, Groves, Roccaforte, & Tomasuolo, 2011; Schooner, Nordlöf, Klasander, & Hallström, 2017). The teachers' practice aligned with the conclusion of Scheetz (2012) that the proliferation and availability of computers opened new avenues for students who are DHH to connect with others through video conferencing technology and videos posted on YouTube. Scheetz (2012) determined that global boundaries have consequently reduced, and persons who are DHH are now able to engage in conversations with other community members. This connectivity fosters a sense of collective identity.

I perceived teachers integrate EET to support their students' language development to communicate thoughts, feelings, opinions and numeracy skills (Harrison & Lee, 2018; Shahhoseiny, 2013). Further, teachers integrated various EET into the curriculum subjects in varying ways for problem-solving, decision-making, social growth, collaboration and cooperation (Kale & Goh, 2014; Mohamed, 2018; Morris, 2010). The EET expanded the students' educational opportunities by providing equity and inclusion (Denham & Battro, 2012) and allowed teachers and students to overcome distance and time barriers (Berge, 2013; Kulik & Kulik, 1991). Further, EET supported the growth of students' cognitive and learning skills and enriched their lives socially (Edyburn, 2013; New Zealand Ministry of Education, 2007b). Thus, because of my interest in educational resources and resourcing services, I wished to research the teachers' views on the pedagogical practices of integrating EET when teaching students with additional learning needs, in this case, students who are DHH.

New Zealand curriculum.

In New Zealand, technology is a compulsory subject for all students/akonga in Years 1 – 10. After that, it is an optional subject in senior secondary schools (Years 11 –

13). The New Zealand Ministry of Education provides various initiatives to support the integration of EET in teaching. An example of an initiative is that teachers in the state and state-integrated schools receive three-yearly leased laptops and other relevant digital devices to support their teaching practices (Bolstad, 2017; Bolstad et al., 2012; Yueng, Taylor, Hui, Chiang, & Low, 2012). Most schools have broadband, which is essential for online communication with staff and students across the geographic spread of the two New Zealand deaf education centres (Board of Directors of Network for Learning Limited, 2015; Bolstad et al., 2012; Moller & Harvey, 2008). Ministerial initiatives further provide an e-learning framework (New Zealand Ministry of Education, 2014a) and a dedicated e-learning website (New Zealand Ministry of Education, 2017e) to inform teachers on current EET.

The New Zealand Ministry of Education first introduced technology as ‘Technology in the School Curriculum’ in 1995 (Jones, 1997; Milne, 2017). A revision of the New Zealand Curriculum took place in 2007 (New Zealand Ministry of Education, 2007a, 2007b). This revision placed greater emphasis on inquiring into students’ learning needs, examining the school’s effectiveness in meeting those needs, and reaching an agreement on the conditions for learning to strengthen the impact of the school’s programs and practices (New Zealand Ministry of Education, 2007a). The most recent iteration of the technologies curriculum is Digital Technologies/Hangarau Matihiko (New Zealand Ministry of Education, 2017a). It is an integral strand of the current technology curriculum and adds to this curriculum by developing computational thinking, giving students a theoretical understanding of how the technology works, and includes the principles of computer science (Catlin & Woollard, 2014; New Zealand Ministry of Education, 2017a, 2018a).

Digital Technologies/Hangarau Matihiko (New Zealand Ministry of Education, 2017a) became compulsory in January 2020 for Year 1 – 10 students and optional for Year 11 – 13 students. These older students can specialise in those digital skills required for the digital technologies industry and digital world by covering six interlinking learning outcomes, namely algorithms, data representation, digital applications, digital devices and infrastructures, humans and computers, and programming (Hipkins, 2017; New Zealand Ministry of Education 2017a). It provides opportunities to teach from a future-focussed digital pedagogy perspective that is learner-centred and designed to emphasise critical and creative thinking (Reinsfield, 2018). To support the integration of Digital Technologies/Hangarau Matihiko, the New Zealand Ministry of Education provided a comprehensive package of resources. These resources include professional learning opportunities and support services for teachers/kaiako to ensure that its implementation and permeation is purposeful and widespread (New Zealand Ministry of Education, 2017a; Reinsfield, 2018).

The inclusion of the Digital Technologies/Hangarau Matihiko curriculum (New Zealand Ministry of Education, 2017a, 2018a) occurred after my studies commenced. I, therefore, note its potential to move teachers rapidly from their position at the time of participating in my research instruments to new levels of integrating EET in their teaching practices. Of significance is that the New Zealand Digital Skills Forum (2016) and the House of Lords Select Committee on Digital Skills (2015) reported that digital skills require the same level of importance as numeracy and literacy.

From this background study, I developed the problem statement, clarified the purpose of the research, and identified the research questions. I also justified the rationale and significance of my research and explained this in the next section.

Problem Statement

This research aimed to address the problem of the dearth of literature in the field of the integration of EET by teachers of students who are DHH. However, during this study, an additional problem became apparent. This problem, also related to a lack of literature and application in practice, was uncertainty on the elements and contextual influences of a theoretical framework that support the unique educational requirements of students who are DHH when integrating EET into pedagogy.

A plethora of empirical peer-reviewed research exists on mainstream teachers' integration of EET for teaching their students (Kivunja, 2014; Livingstone, 2012; Uerz, Volman, & Kral, 2018). On the other hand, there is a paucity of research and little empirical evidence on how, when, and why teachers of students who are DHH integrate these technologies to meet their students' learning needs (Baglama, Haksiz & Uzunboylu, 2018; Knoors & Marschark, 2014). Equally, there is little research on teachers' perceptions of the role of these technologies in their teaching and the extent of benefit for student learning (Beal-Alvares & Cannon, 2014). Also, there is sparse research on the use of the Internet as a means of breaking down barriers between the world of DHH and hearing people (Valentine & Skelton, 2009). Further, there is scarce research on how social sites and online communities might encourage connections and networking (Kožuš, Hintermair, Holzinger, Volčič & Debeve, 2015). Moreover, little research supports non-formal education opportunities such as e-learning (Kožuš, Hintermair, Ivanišin & Debevc, 2014). Instead, Barak and Sadovsky (2008) concluded that research focussed on technology use by adults who are DHH rather than on children.

A further aspect of the problem is that given the limited auditory input that DHH students might have, despite the advancements in technology, the use of visual aids is essential to support the learning of these students. Given its visual and tactile features,

EET can potentially serve as a valuable resource to support DHH students in their study of the curriculum - such as literacy, access to language and abstract concepts - an additional problem became grounding this practice into a theoretical framework. The argument of a framework is to provide a foundation for EET integration in educating current generation students who are DHH. These students desire in-class and out-of-class learning experiences that are active, participatory, visual, collaborative, fast-moving, requiring quick-thinking, rapid in response, emotionally freeing, and spontaneous (Berk, 2010).

Constantinou, Ioannou, Klironomos, Antona, and Stephanidis (2018) concluded their investigations with a call to educational researchers to address this shortage through rigorous and replicable intervention studies. This situation and my interest in teachers' integration of EET in their pedagogy further motivated me to contribute to the limited body of research literature on integrating EET in learning by teachers of students who are DHH.

Purpose

My research investigated the integration of EET by teachers of students who are DHH in New Zealand. It had four purposes, the first being to examine the views and practices of these teachers regarding their integration of EET in their pedagogy. The second purpose was to ascertain the challenges of integrating EET in education. By addressing these challenges, I was keen to discover the opportunities for progress in student's language development, learning and social growth that could occur through the positive implementation of these technologies. The third purpose was to identify teachers' perspectives on the significance of school leadership in integrating these technologies in their teaching. This purpose arose from the significance of leadership for implementing EET policies and practices and my involvement in a leadership role that

could directly support EET integration in teaching. The fourth purpose was to consider the elements of theoretical frameworks that underpin the practice of integrating EET to student-centred inquiry when teaching students who are DHH.

To achieve these purposes, I used an explanatory sequential mixed methods research design. This design commenced with quantitative data collection and analysis. The results of the quantitative data were then further investigated through the study of qualitative data. I then interpreted the combined data to isolate findings for discussion and draw conclusions (Creswell & Plano Clarke, 20018). The rationale for the mixed methods research is that it combines quantitative and qualitative research approaches and techniques to gain breadth and depth of understanding and corroboration in a single study (Creswell, 20014; Creswell & Plano Clarke, 20018). This design has two phases: first quantitative data is collected from participants to provide general data on the research problem, and then qualitative data is gathered to refine, extend, explain and corroborate the general data for reporting. This sequence allowed for the concurrent examination and analysis of both quantitative and qualitative data to gain multiple viewpoints and insights on my research topic (Creswell, 2014; Creswell & Plano Clarke, 20018; Ivankova, Creswell & Stick, 2006). Quantitative data provided statistical information to indicate measurements relating to quantity and amounts.

The second phase of the design provided qualitative data evidence from interview transcripts, notes, video and audio recordings, images, and text documents that I could categorise based on traits and characteristics (Creswell, 2014; Merriam & Tisdell, 2016; Yin, 2018). I obtained this data, to which teachers of the two deaf education centres in New Zealand could voluntarily contribute, through an online survey and in-person interviews. The data examination results supplemented the limited empirical evidence on

integrating these technologies as valuable resources and beneficial practices in teaching students who are DHH.

The value of this research resides in its contribution to literature and the data it provides for policymakers, educational leaders, and teachers on integrating EET by teachers of students who are DHH to support the students' learning. Therefore, the research required data mining from the literature and two research instruments concerning integrating EET and synthesising it to establish elements and contexts that benefit and support teachers in providing the best outcomes in student learning. I trust that my findings and recommendations might attract the attention of further and future research to expand on the subject of teachers' integration of EET in their pedagogy when teaching students who are DHH.

Research Questions

This study's overall focus was to investigate and address the problem of limited research on integrating EET by teachers of students who are DHH (Hart, 2005; O'Leary, 2004). Four research questions helped guide this study towards that focus. Three questions explored the survey responses and participant interview responses based on EET experiences in their pedagogy. Because of the critical role of leadership in implementing policies and procedures that support the application of EET in pedagogy, I developed a fourth question. This question studied teachers' perceptions of leadership practices to support their EET integration in their teaching. Collectively the questions studied teachers' knowledge, beliefs, attitudes, perspectives, and experiences of EET to support, extend and enrich the language development, learning progression and social growth of their students (Barnes & Kennewell, 2016; Chen, 2008; Molstad Gorder, 2008). Responses to these four research questions were central to informing the

discussion, results, conclusion, recommendations and proposals for further research addressed in the following chapters of this study. The research questions are as follows:

Question One: How are teachers of students who are deaf or hard of hearing in New Zealand integrating emerging educational technologies into their teaching?

Question Two: What are the opportunities and challenges faced by teachers of students who are deaf or hard of hearing, and the support required by them to integrate emerging educational technologies into their pedagogy?

Question Three: What features of the emerging educational technologies do teachers of students who are deaf or hard of hearing perceive as positive and negative to student-centred inquiry outcomes and social growth?

Question Four: What leadership practices do teachers of students who are deaf or hard of hearing perceive as enabling or hindering the equitable implementation of emerging educational technologies for student-centred inquiry?

The reason for the first question was to gather evidence on the actual use of EET by teachers of students who are DHH. The second question aimed to examine and confirm teachers' personal and organisational experiences of their opportunities and challenges for integrating EET in their day-to-day teaching task. The third research question allowed for investigating teachers' positive and negative experiences in their student-centred inquiry teaching practices and relationships when integrating EET as educational resources. The fourth research question intended to ascertain the teachers'

views and beliefs on the support required from their leaders concerning their desired EET integration opportunities.

Rationale

The rationale for this study resides in its originality and contribution to knowledge on the experiences and pedagogical practices of teachers of students who are DHH by identifying the enablers and barriers faced in EET integration. The rationale for using numeric and text data in this explanatory sequential mixed methods research design, triangulation of data, and the researcher's experience and background is that together these provided a more comprehensive understanding than either quantitative or qualitative data could provide. Mixed methods allowed me to collect quantitative data before qualitative data for my investigation (Creswell & Plano Clark, 2018; Onwuegbuzie, Collins, & Frels, 2013; Shorten & Smith, 2017). This sequence allowed me to converge the data to address and triangulate my research problem, research questions, findings and conclusions (Brown, 2008; Neuman, 2016; Nichols, 2003). Although data collection occurred at different times, the findings worked together to answer the four research questions related to a teachers' competent integration of EET to support, enrich, and extend their teaching and promote the language development, learning progression, and social growth of students who are DHH.

Significance of the Research

My literature study revealed the potential of EET as mediating resources and methods to support, extend and enrich language development, student-centred inquiry and social growth in mainstream education (Attard et al., 2010; Churches, 2008; Tangney, 2014). Therefore, the significance of my research is primarily its contribution to the literature gap on this practice concerning teachers of students who are DHH in New Zealand (Hinostroza, Ibieta, Claro, & Labbé, 2016). An additional significance is

that this research recognised teachers' perceptions of laying the foundation and practices for continued professional learning about EET, as self-directed learning to acquire knowledge and skills over one's life span (Dumont, Istance Benvides, 2012).

Another matter of significance is that this research recognises the importance of informed decisions to integrate EET in teachers' pedagogy through strategic planning by school leadership (Bolstad, 2017; Williams & Johnson, 2013). Also of significance is perspectives of teachers and leaders on identifying elements and contexts of a theoretical framework, such as the TPACK framework, to underpin the purposeful integration of EET in pedagogy (Mishra & Koehler, 2006). Moreover, my research is of significance in that it is transferable and replicable to other population groups and communities and can be relevant in similar DHH contexts across the world. It potentially provides a basis for advancing future related research, exploration, discussion and international collaboration (Abdalla, Olivera, Azevedo, & Gonzalez, 2017; Loveless, 2010; Webb & Cox, 2004). Underlying my research is the hope that it may contribute to equitable and inclusive practices in education where EET improves outcomes for a potentially vulnerable student population (Edyburn, 2013; Garberoglio et al., 2011; New Zealand Ministry of Education, 2016).

Contexts of the Research

Teachers integrate EET in their pedagogy to support the enrichment, enhancement, and extension of their students' learning. However, teachers' integration of EET in their pedagogy may also create suppositions (Hammond, 2014; Pandolfini, 2016; Uluyol & Şahin, 2016). Therefore, keeping these circumstances in mind, I explored literature and identified eight contexts relating to the integration of EET by teachers of students who are DHH. The first context concerned the benefits of integrating EET in the education of students who are DHH (Johnson et al., 2017; Scherer et al., 2015). The

second context examined the requisite for acquiring digital skills (Gudmundsdottira & Hatlevik, 2018; Melhuish, Spencer, Webster, & Spence, 2018). The third context related to teachers' integration of EET to strengthen their pedagogy (Knoors & Marschark, 2014; Lidström & Hemmingsson, 2014). The fourth context investigated the unique considerations for the education of students who are DHH (Antia, Jones, Luckner, Kreimeyer & Reed, 2011; Combined Board of Trustees, 2019; Easterbrooks et al., 2015). The fifth context considered professional learning/whanake ngaiotanga in the use of EET (Darling-Hammond, Hyler, & Gardner, 2017; Donohoo & Velasco, 2016; Hsu, Hung, & Ching, 2013). The sixth context explored the role of leadership/te kanohi mataara in supporting teachers to integrate EET in their pedagogy (Cotter, 2018; Kurian & Ramathan, 2016; Ruggiero & Mong, 2015). The seventh context scrutinized EET as a resource to support collaborative practices/mahi ngātahi (Morel, 2014; Vandenhousten, Gallagher-Lepak, Reilly, & Ralston-Berg, 2014). The eighth context studied the impact and disruption caused by change (Howard, 2019; New Zealand Ministry of Education, 2020; Parlakkilic, 2013). I introduce these context below and expand on them in the literature review of Chapter Two.

Benefits of integrating EET in the education of students who are DHH.

I explored literature that identified the benefits of integrating EET for teachers' pedagogy of students who are DHH. These technologies also provide benefits for communication and contributing to the internet. However, the rapid changes in technology call for a consistent reassessment of the benefits of these EET.

Teachers' integration of EET in learning appears to be increasingly significant in providing potentially powerful resources for knowledge and information acquisition and social connectedness (Caica, 2011; Johnson et al., 2017; Scherer et al., 2015). The inclusion of these technologies appears to benefit the unique learning requirements of

DHH students (Scheetz, 2012) as their teachers use them to explain, support and assess learning tasks (Prieto, Villagr -Sobrino, Jorr n-Abell n, Martinez-Mon ez, & Dimitriadis, 2011). Knoors and Marschark (2014) affirmed that the possible contributions of technological multimedia-enhanced instruction are an exciting and promising development across all stages of these students' schooling.

Stinton (2010) recognised that EET appear to support the communication of students who are DHH. Barak and Sadosky (2008) found that these students use the Internet more intensely and extensively and for more extended periods than their hearing peers, particularly for personal and social group communication. Two equally important goals for integrating EET in these students' education are that the application should achieve the desired educational purposes and that both teachers and students use the technologies (Elsendoorn, 2002).

Further, students are contributors to Internet content. They learn by inductive discovery, multitasking, moving quickly from one activity or medium to another, and communicating visually (Berk, 2008; Kuntze, Golos, & Enns, 2014). Berk (2008) also notes that students are emotionally open to meet new people and share information, prefer teamwork and collaboration, and favour typing to handwriting. Further, EET may bring value by supporting and transforming topics that students find difficult to understand or that teachers find challenging to represent (Angeli & Valanides, 2009).  rlestig (2009), Browning (2013), and Harris, Caldwell and Longmuir (2013) established that EET could support the complex and multidimensional process and environment of open dialogue and communication. Whitehead (2017) recognised that integrating these technologies to support social growth could provide tools to answer questions, learn vocabulary about feelings, make records of work, and offer communication resources.

Other research findings supporting the view that EET hold benefits in education include Bull (2009), Inan and Lowther (2010a), and Mishra and Koehler (2009a). They concluded that these technologies could change how those involved in education think about their teaching and learning. Berk (2010) identified generalised characteristics of the current generation of learners who mix work and play as standard practice. He indicated that it is essential to understand how students use EET to benefit from the technology tools. These features include the students' technology know-how, their reliance on search engines for information, and their interest in multimedia.

While EET have the potential to influence education, adjustments caused by their integration may fundamentally change the relationship between teachers and students and the connection between teaching and learning (Kuiper, Volman, & Terwel 2005, 2008a, 2008b). Teachers base their innovative use and integration of EET to support educational goals on the needs of the current knowledge society (Drent & Meelissen, 2008; Petko, 2012). It appears, therefore, that for EET to benefit education and pedagogy, the relationships between these technologies and the realities of everyday life – such as attitude and beliefs, skills and tools, and teaching – need careful consideration (Burnett, 2016; Prestridge, 2011; Vongkulluksn, Xie, & Bowman, 2018).

Acquisition of digital skills.

Achieving digital fluency requires a combination of digital, literacy, social, relational and communication proficiency and competence (Gudmundsdottira & Hatlevik, 2018; Melhuisch et al., 2018). The goal of digital fluency implies knowledge (cognition), understanding (application), and wisdom (analysis and evaluation) for integrating EET in learning. The New Zealand Ministry of Education (2014a) provides a matrix to plot leadership, personal and organisational awareness of proficiency levels in technology skills. Greater accuracy in the support required to achieve the next step in

learning comes from identifying the progression of EET skills as emerging, engaging, extending or empowering (New Zealand Ministry of Education, 2014a).

Teachers' integration of EET.

Teachers integrate technology in their teaching for various purposes such as administration, assessment, and support teaching and learning (Sadeck and Cronjé, 2017). Further, teachers tend to use EET according to their comfort zone, progressing from simple to innovative. Kim and Downey (2016) concluded that the six-step instructional system design process of the ASSURE instructional model for the integration of EET might have positive outcomes for teaching and learning. These steps are analysing the students' learning needs; stating standards and goals; selecting strategies, technology, media, and materials; utilising technology, media, and materials; requiring student participation; and evaluating and revising (Kim & Downey, 2016; Nurdi, 2017; Smaldino, Lowther, Russell, & Mims, 2008).

Although deafness poses challenges for inclusive and interactive education, EET potentially benefit students who are DHH in additional ways to their hearing peers as these technologies provide means for access and inclusivity in communication and learning (Lidström & Hemmingsson, 2014). Therefore, teachers' adaptation of EET resources to support teaching is necessary to ensure that students clearly understand the instructions and the responses and actions (New Zealand Ministry of Education, 2015a; Xie, Potmčšil, & Peters, 2013; Zlamanski & Ciccarelli, 2012).

As English may not be the students' first language, communication levels require adaptation. EET might provide teachers with support for learning access. While sounds often inform hearing users about their actions, responses and meaning of information, students who are DHH are inclined to receive this information visually (Caica, 2011; Knoors & Marschark, 2014). Pictorial integration of EET may support their students'

access to language, literacy, writing, spelling, and abstract concepts through images and icons for understanding the dialogue (Heitink et al., 2017; Mumtaz, 2000). Further, EET resources may enhance and extend the students' assignment of meaning to information and communication because of their visual and tactile features (Nikolarazi et al., 2013).

Education of students who are DHH.

Matters of importance to the pedagogy of students who are DHH include the provisions made for their education, the support of their social growth, and the circumstances that affect their education (Hintermair, Cremer, Gutjahr, Losch, & Straues, 2018). Being fully informed through objective evidence and setting aside philosophical and emotional considerations will allow ways forward in the education of students who are DHH (Marschark & Rhoten, 2007). Further, these students' requirement for individualised instruction recognising Bronfenbrenner's bioecological systems theory (Anderson, Boyle, & Deppler, 2014; Christensen, 2016; Rosa & Tudge, 2013) and the individual education plan (Fiedler, 2001; New Zealand Ministry of Education, 2011a). As a substantial number of students who are DHH in New Zealand are Māori, and Māori is an official language of New Zealand, I investigated the educational opportunities for these students (Clements, 2016; D'Cunha, 2017; New Zealand Ministry of Education, 2011b).

Professional learning/Whanake ngaiotanga.

From my working relationship with teachers, I identified their need for professional learning for a comprehensive understanding of the integration of EET to support, advance and enable contemporary student-centred inquiry. The goal of professional learning is to inform and change behaviour as a result of new information. It, therefore, needs to relate to the curriculum, be classroom-based, provide training in

diagnostic and national assessments, and include instruction for effective pedagogy (Darling-Hammond et al., 2017; Donohoo & Velasco, 2016; Hsu, Hung, & Ching, 2013).

The Consortium of School Networking (2019) indicated that no technology has the desired impact without providing the users with appropriate professional learning to facilitate and understand the significance of the educational shift brought about by a particular technology or technology practice (Chang, Chin, & Hsu, 2008; Davies, 2010; Schachter, 2010). Keeping interested and updated on EET during and after teacher training requires ongoing professional learning and time to understand and integrate these technologies and practices (Akaslan & Kull, 2017; Kazu, 2011).

Leadership/Te kanohi mataara.

My leadership position provided insight into the current teaching situations, practices and barriers regarding EET. Also, this position provided access to consult with other managers and resource staff to support decisions on the practices and the acquisition of relevant EET resources. In this section, I studied leadership practices that enhance the integration of EET in pedagogy and the role of leaders in supporting equity and inclusion of these technologies.

Successful leadership practices are significant for shaping teachers' instructional behaviours and improving student learning (Leithwood, Patten, & Janzi, 2010; Leithwood, Seashore, Anderson, Wahlstrom, & Centre for Applied Research and Educational Improvement, 2004; New Zealand Education Council, 2018b). Louis, Dretzke and Wahlstrom (2010) concluded that shared leadership and instructional leadership concentrate on school improvement and complement each other. Increased EET integration in education requires leaders to address specific issues relating to teachers' purposeful and collaborative interaction with these technologies in their teaching practices (Supovitz & Tognatta, 2013; Webster, 2010). Leaders need to organise

and provide for teachers' professional learning to stay updated regarding the rapidly accelerating new technologies in teaching practices (Australian Council for Educational Research, 2013; Kurian & Ramathan, 2016; Rotolo et al., 2015). A distributed leadership approach for integrating EET appears to support sound pedagogical practices (Lidström & Hemmingson, 2014; Ruggiero & Mong, 2015; Scheetz, 2012). Distributed leadership supports well-designed teaching and learning environments, access to information and collaborative approaches to help individual students' learning (Harris, 2010; Harris, Leithwood, Day, Sammons, & Hopkins, 2007).

The occurrence of inequity may affect the language development, learning progression and social growth of students who are DHH in various ways and degrees (New Zealand Ministry of Education, 2018c). The inequity of access to these technologies might also arise because of poverty and social inequality, geographic dispersion, disabilities and language barriers (Dibaba & Ramesh, 2017; Thunman & Persson, 2013). Therefore, an essential issue for leadership relates to providing equity and inclusion for teachers and students to access hardware, software, apps, Internet connectivity, and professional learning about EET. Students' education, language development, learning progression and social growth require such equity and inclusion (Anderson et al., 2014; New Zealand Ministry of Education, 2010; 2015a). The New Zealand Ministry of Education (2018c, 2020) recognises that equity gaps persist in access to and practices of EET for Māori, Pasifika, special needs, and low-socioeconomic status students. As outlined by Cotter (2018), impediments to equitable access to EET by leaders may arise from mediocre social policy design and implementation and the absence of ongoing and updated review procedures for policies and protocols (Cotter, 2018). Another contributing factor to inequity is insufficient investment in ongoing

research by leaders to expose and address gaps in the current knowledge about EET as resources and practices in teaching.

Collaborative practices/Mahi ngātahi.

Collaborative skills for effective learning is not a new phenomenon. However, these skills appear to be newly important (Valtonen et al., 2017). Technology for collaboration is inseparable from social and cultural influences and historical impacts. Contemporary technological practices increasingly rely on collaboration between people to share skills, create outcomes, and navigate the challenges and opportunities of EET (New Zealand Ministry of Education, 2010, 2019b; Texas National Agenda Collaborative, 2012). Kinsella-Meier and Gala (2016) concluded that collaboration provides opportunities to pool knowledge from diverse people to create something new and more robust than any individual might accomplish alone. Benade (2017) identified that collaborative practices require participants to build on solid relationships of trust, respect and commitment by taking time to develop interdependent collective responsibility directed towards positive student achievement. Collaborative integration of technologies leverages the varied perspectives and the skills of those working together and can promote creativity and productivity (Ilomäki, 2008; Laurillard, 2009; Morel, 2014; Vandenhousten et al., 2014).

Change.

Changes in EET in education require teachers to upskill and develop professionally. Change facilitates new perspectives on student-centred inquiry, collaboration as practitioners and encourages research (Håkansson Lindqvist, 2019; Sun & Gao, 2019). Changes caused by the introduction and use of EET are inevitable, and the resulting disruption and emotional reactions require the strategic planning of leadership

(Howard, 2019; Lee & Yin, 2011; Seely Brown, 2016). Leaders need to recognise the stages of development that staff experience when change occurs (Wilson, 2010).

The implementation of change by school leadership requires a clear vision, goal-setting and careful monitoring of progress, decision making, and communication. Change strategies include the support and development of people, strategic resourcing, problem-solving, and the assurance of an orderly, safe and inclusive environment (Bendikson, 2015; European Commission, 2017). The disruption brought about by changes in EET needs consideration in terms of its impact on pedagogy, costs and technical implementation. Changes require acceptance and a willingness to implement and integrate these variations, choices and new practices as opportunities for language development, learning progression and social growth (New Zealand Ministry of Education, 2020; Parlakkic, 2013).

Based on the evidence of these eight contexts, I next progressed to identify a theoretical framework that could accommodate and represent the elements and contextual influences on which to structure the practices of integrating EET in the education of students who are DHH. In the remainder of this chapter, I explain the significance of having a theoretical framework to base the practice of integrating EET into pedagogy. I also explain my role as the researcher of this study and clarify the organisation of my thesis.

Theoretical Framework

Further challenges may result from the lack of a theoretical/philosophical foundation of embedded beliefs to define and understand teaching with EET (Tondeur et al., 2016). A theoretical framework, alongside strategic planning for integrating EET in pedagogy, can address challenges such as teachers' possible lack of confidence and taking their pedagogical beliefs into account (Donnelly et al., 2011; Ng, 2015). Without a

framework, teachers' effective strategic planning and commitment to incorporate EET in their pedagogy become challenging (Cheok & Wong, 2015; Webb & Cox, 2004).

Based on a theoretical framework, strategic planning can address targeted matters and goals such as careful selection of appropriate technologies from the many competing products, some of which may be ineffective for learning resources (Hsu, 2010, 2016). Further, based on a theoretical context, strategic planning can support the ongoing implementation of professional learning and resources at the school (Ertmer, Ottenbreit-Leftwich, 2010; Inan & Lowther, 2010a). Strategic planning seeks solutions to providing EET at home and technical support staff for equipment failures and compatibility issues (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). Strategic planning ensures that a dedicated budget is in place for the costs of hardware equipment, software, networking, licencing, repairs and maintenance, professional learning, technical support and supplies. Also, strategic planning creates an environment with cyber-safety, cyber-security, and resilience of all systems, processes, platforms and the Internet (Kopcha, 2012; Valcke De Wever, Van Keer, & Schellens, 2011).

By investigating various theoretical frameworks relating to EET, I intended to identify and explain the aspects and contextual influences of pedagogies and leadership practices supporting students' language development, learning progression, and social growth. A theoretical framework for integrating EET serves as a structure to guide and support a concept of practice and interrelated key variables (Aparicio, Bacao, & Olivera, 2016; Kelly & Kellam, 2009). Eaton (2015) and Knoors and Marschark (2015) believe that teachers of students who are DHH need to consider different frameworks for effective teaching with EET. Although teachers at the two centres used student-centred inquiry practices, they did not appear to include a conceptual theory to explain their philosophical reasoning for embracing the integration of EET in their pedagogy.

Therefore, the necessity of a theoretical framework to represent and conceptualise the integration of EET is significant in my research (Anderson, 2016; Webster, 2016, 2017). I was drawn to the TPACK framework (Koehler, Mishra, & Cane, 2013; Mishra & Koehler, 2006) (see Figure 5) as it has received ample attention from researchers (Baran & Uygen, 2016; Bibi & Khan, 2017; Di Blas, 2016). TPACK emphasises three knowledge areas and the connections, interactions, and constraints that teachers navigate within these (Archambault & Barnett, 2010; Baran, Chuang, & Thompson, 2011; McGraw-Hill, 2020). The TPACK knowledge sets consist of pedagogical, content and technological expertise (Charoula & Valanides, 2009; Koehler & Mishra, 2009; Mishra & Koehler, 2006).

I investigated TPACK, which accommodates various theories of learning. These include the constructivist theory as developed, amongst others, by Vygotsky (Van der Veer, 2007; Vygotsky, 2016), Piaget (Carey, Zaitchik, & Bascandiev, 2015; Perret-Clermont & Barrelet, 2008; Walczak, 2019), Dewey (Beckett, 2018; Dewey, 1903, 1907, 1997) and Bruner (Bruner, 1983, 1991; Takaya, 2008). Constructivism recognises that learners' base their understanding and knowledge on their own experiences and reflections. This theory laid the foundation for student-centred inquiry (Chegenizadeh et al., 2012). A further theory is the ecological systems theory of Bronfenbrenner, which emphasises the importance of considering children within multiple environments as each ecological system interacts and influences the other in all aspects of the child's life (Bronfenbrenner & Morris, 1998). Other theories expressed in frameworks and models similarly support the strengths and benefits of integrating EET in teaching. These theories include the Substitution, Augmentation, Modification and Redefinition (SAMR) model (Hamilton, Rosenberg, & Akcaoglu, 2016) and the Replace, Amplify Transform (RAT) model (Hughes, Thomas, & Scharber, 2006). Three other theories are Jonnason's

model of technology (Jonassen, 1999), the Technology Integration Model (TIM) (Bonfiglio-Pavisich, 2018) and the MLearning model for mobile learning (Grant, 2019).

The TPACK framework (see Figure 1), which is of interest in my study, allows for reflection on the requirements of everyday teaching practices in the context of teachers' integration of EET in their teaching of students who are DHH. Further, the TPACK framework application can extend language development, learning progression, and social growth of students who are DHH (Baran & Uygun, 2016; Brown & Paatsch, 2010; Consortium for School Networking, 2019).

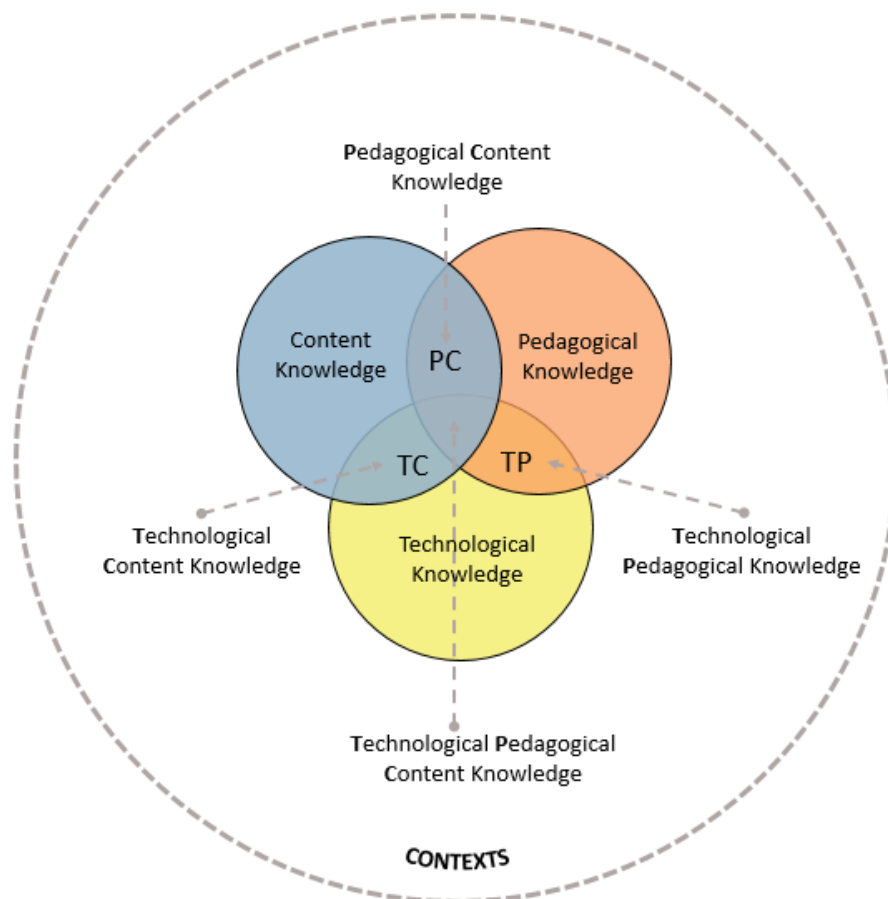


Figure 1. The TPACK framework (as illustrated in Koehler & Mishra, 2009, p. 63. Reproduced by permission of the publisher, © 2012 by tpack.org).

TPACK also allows for acknowledging the complex, diverse and multi-dimensional reality of teachers' everyday practice when using educational technologies

(Koehler & Mishra, 2009; Koh, Chai, & Tsai, 2013; Niess, 2011). This framework accommodates extension beyond the isolated knowledge domains of content, pedagogy and technology to include the dynamic interplay of its domains and subdomains. Such interaction accounts for wide variations in EET integration across diverse settings (Koehler et al., 2013; Mishra & Koehler, 2006). Further, in the context of education for students who are DHH, TPACK might provide an accessible visual explanation and understanding of theoretical concepts, principles and values to prepare students for their current learning and their future.

Role of the Researcher

When I conducted my research instruments in 2018, I was resource manager at Kelston Deaf Education Centre, New Zealand. The work included managing the team responsible for distributing and maintaining digital technology networking, hardware, software, and applications (apps). The desire and requirements for the effective application of EET in the teachers' pedagogy influenced my leadership practices and research focus. Consequently, my professional role placed me in a unique position to investigate and fulfil the requirements for this doctoral research. The relationship between the research participants and myself was such that we all worked for the education of students who are DHH in New Zealand.

My research role was to gather data through an online survey and find participants from the responses to the survey to partake in a semi-structured interview. This process allowed using an interview protocol to help guide the conversation between myself as the researcher, and details of the participants' experiences, opinions, thoughts and feelings (Creswell, 2014; Merriam & Tisdell, 2016). The function of the interviews was to elicit in-depth data from the participants on the research topic. This data included their opinions, attitudes, perceptions, understandings, experiences, and reasoning for

integrating EET in their teaching (Scherer, Tondeur, Siddiq, & Baran, 2018). The data included descriptions of events relating to their teaching experiences with EET (Creswell, 2014). The semi-structured interview format provided a balance of structure between the flexibility and adaptability of an unstructured, open-ended interview and the rigorous focus of a structured survey that does not allow for digressions. It allowed me to ask all the set questions for my research investigation from each participant while also permitting me to discuss and probe into matters of interest or needing greater detail and clarity (Mojtahed, Nunes, Martins, & Peng, 2014; Rabionet, 2011).

The University of Newcastle's research guidelines allowed me to address potential bias in data collection, analysis and interpretation by ensuring a secure and transparent process and experience for the research participants (University of Newcastle, 2017). Further measures to address research bias included adequate peer-reviewed preparation of the survey and interview questions and a rigorous data analysis design to avoid misrepresenting results (Cohen, Manion, & Morrison, 2004; Creswell, 2014; Merriam & Tisdell, 2016).

Organisation of the Thesis

I developed my research on EET integration in the pedagogies of teachers of students who are DHH through six chapters. Chapter One explains the background, theoretical context and describes considerations for the integration of EET in teaching, the purpose of my research, the research questions, and my role as the researcher. It also states the significance of the study and describes the organisation of the thesis.

Chapter Two contextualises my study within the relevant literature by relating it to my purpose and the research questions. This chapter provides an in-depth literature review focussing on teachers' integration of EET in their pedagogy when teaching students who are DHH. I investigated worldwide usage, trends, purpose and challenges

of these practices. The literature review included an investigation of professional learning for the implementation of EET in pedagogy. Further, I reviewed the literature on leadership practices, which teachers perceived as supporting their EET integration. Also, I examined theoretical frameworks when including EET in pedagogy and explored the TPACK framework in greater detail (Koehler & Mishra, 2009; Mishra & Koehler, 2006).

Chapter Three describes my research methodology, analysis of the research design, demographics of the setting and participants, and my research methods. I used two research instruments: a national online survey and fourteen interviews to collect data for analysing, synthesising, and finally disseminating the results. The chapter also describes the processes of ethical compliance and data collection.

Chapter Four details how the data was analysed and provided a written and graphic summary of the results. This chapter reports on the regularities and variations of the analysed data. Further, this chapter discusses the reliability of the data deriving from five themes closely linked to the four research questions. This chapter's five themes became meaningful for the discussion in Chapter Five and the results in Chapter Six. These themes covered participants' views on pedagogy, technology use, opportunities and challenges when integrating EET, professional learning and leadership.

Chapter Five reflects on the data findings as related to the four research questions. A summary presents the discussion of each of the four research questions. This chapter also reflects on the significance of an EET theoretical framework, particularly the TPACK framework (Koehler & Mishra, 2009; Mishra & Koehler, 2006).

Chapter Six, the final chapter, presents the findings and recommendations drawn from the data and insights gathered through my research journey. Further, the findings highlight additions to the TPACK framework contexts (Koehler et al., 2013). The findings also present the IEET-DHH framework, based on the investigation of this thesis,

to make it more meaningful for the education for students who are DHH. Chapter Six also reflects on the research limitations, makes recommendations, and proposes areas for further research.

Summary

This chapter provided the background on the intentions, contexts, problem and purposes of developing my study. Further, I established the research topic parameters regarding New Zealand teachers' integration of EET in pedagogy when teaching students who are DHH. While teachers integrate EET in their teaching practice from the curriculum, there is no substantive research on using these technologies to benefit the learning.

The first research purpose centred on addressing the gap in the literature concerning the integration of EET in teaching practices by teachers of students who are DHH. The second purpose was to ascertain the challenges and barriers to integrating EET in teaching. The third purpose was to identify teachers' perspectives on the significance of school leadership in integrating EET in their teaching. The fourth purpose was to define a theoretical framework for integrating EET in student-centred inquiry education was central to this investigation. A final motivation was to develop a study that is replicable and of relevance in similar educational contexts.

From the reflection on the background, problem and purpose of this research, I developed the four main questions to guide my analysis. I then introduce nine premises of importance to this research. These premises reflected on the benefits of integrating EET in the education of students who are DHH and the acquisition of the digital skills of digital proficiency, fluency and citizenship for purposeful and safe practices when integrating EET in teaching. The third premise focussed on teachers' integration of EET to facilitate learning activities that support, extend, enrich and develop higher-order

thinking skills (Neyland, 2011). Further premises included the education of students who are DHH, professional learning about EET, school leadership concerning EET, collaborative practices and the impact of change brought about by EET.

Furthermore, this chapter introduced the TPACK theoretical framework to ground the pedagogy that integrates EET (Koehler & Mishra, 2009; Mishra & Koehler, 2006), and I indicated aspects of my researcher role. The last section of this chapter provided an overview of the organisation of this thesis. In the next chapter, I explore the literature on each of the nine premises concerning integrating EET in pedagogy by teachers of students who are DHH.

Chapter Two: Literature Review

PoiPoia te kākano kia puāwai: Nurture the seed, and it will blossom. (New Zealand Ministry of Education, 2019b. p.2)

The literature review in this chapter explored the integration of EET by teachers of students who are DHH to provide research that lessens the gap in the literature on this field and contributes to the education of students who are DHH. This literature review informed my research topic, assisted in formulating the four research questions, and supported my research purpose and methodology. Search terms included the key terms mentioned in the abstract and the contexts of Chapter One and Two. The primary electronic databases for obtaining the literature and peer-reviewed empirical research articles were A+ Education, Elsevier, and EBSCO (Elton B. Stephens Company). Other databases were ERIC (Education Resource Information Centre), Gale Cengage, JSTOR (Journal Storage), ProQuest, SAGE, Scopus, and Taylor & Francis. I also utilised Google Scholar and the University of Newcastle library database.

This literature examination further clarified the five Key Terms and the eight contexts raised in Chapter One. These eight contexts related to the benefits of integrating EET in the education of students who are DHH, the acquisition of digital skills, teachers' integration of EET, and the education of students who are DHH. They also included professional learning, leadership, collaborative practices, and change.

I commenced this chapter with a brief background to the research, history of EET, trends in EET and further developed the eight concepts introduced in Chapter One. Lastly, I investigated theoretical frameworks that guide the theory, methodology and decisions for integrating EET in teaching. In particular, I examined the TPACK

framework developed by Koehler and Mishra (2009), its historical development, the significance of its domains and its contextual knowledge for teachers' pedagogy of students who are DHH. Conducting this review enabled me to develop an understanding of my research problem on the opportunities, best practices and challenges teachers of students who are DHH face when integrating EET in their teaching.

Background

The literature review allowed me to determine the strengths, weaknesses and omissions in the literature on my research topic. As I had identified the paucity of literature on the integration of EET in teaching by teachers of students who are DHH, I selected other sources of literature to guide the course and content of my inquiry and assist in identifying and formulating my research questions. The specific population of interest for my literature investigation was these teachers. Their students range from pre-school (starting at the age of three) through to the optional post-school program (up to the age of 21). After the age of 21 these students transition into tertiary studies or the workforce (Combined Board of Trustees, 2019).

Further, I used the literature to inform my decisions regarding selecting methodology, the process of data collection and the analysis procedures required to reach the conclusions and recommendations of my research. I used the style rules stated in the Publication Manual of the American Psychology Association: Sixth Edition (2017) to guide the formatting of my literature references and structure of reporting.

I primarily consulted research on EET in the decade from 2008 – 2018 as 2018 marked my proposal defence and the data gathering year. Thomson (2013) suggested that a period of ten years provides a timeframe that is long enough to see evidence of possible developments in the field of study. I, therefore, situated most of my literature within

these ten years as I wished to capture the views on current practices at the time of my inquiry in this rapidly changing field.

Historical Context of EET

Digital technologies have influenced education and teacher pedagogy since the advent of personal computers in the 1980s (Papert, 1993). They evolved into their current structures and functions and appear to support communication and hold education benefits (Elsendoorn, 2002; Knoors & Marschark, 2014; Stinton, 2010). Further, they appear to motivate students' curiosity, discovery, constructive peer and community collaboration (Baeten et al., 2010; MacIellan, 2008; New Zealand National Library, 2019). Roblyer and Doering (2014) observed that teaching with EET in the current environment is challenging as it mirrors some of society's most profound and complex issues. They consider that the successful integration of technology into teaching requires teachers to recognise and be prepared to work with all the subtleties and complexities of such environments. The current application of constructivist and connectivist knowledge learning theories in school environments encourages the use of EET for student-centred inquiry learning (Goldie, 2016; Mattar, 2018; Strong & Hutchins, 2009).

Constructivism recognises that students' knowledge results from their experiences, understanding and reflections (Matthews, 2003; Powell & Kalina, 2009; Watson, 2001). Amongst others, Piaget (Carey et al., 2015; Perret-Clermont & Barrelet, 2008; Walczak, 2019), Dewey (English, 2016; Stack, 2007; Williams, 2017), Vygotsky (Derry, 2013; Miller, 2011, Newman & Holzman, 1993) and Bruner (Bruner, 1983, 1991; Takaya, 2008) developed constructivist theories. Constructivism inspires learners to gain knowledge through experiments and real-world problem-solving. Students are encouraged to talk about what they do and reflect on how their understanding changes (Bada & Olusegun, 2015; Richardson, 2003; Yilmaz, 2008). Teachers determine the

students' pre-existing conceptions and guide learning to build on these pre-existing conceptions (Froyd & Simpson, 2008; Van der Veer, 2007; Vygotsky, 2016). Further, teachers provide learning experiences and scaffolded instruction rather than directive pedagogies (Bruner, 1991; Donohoo & Velasco, 2016). Vygotsky termed this space between what the student can and cannot do as the zone of proximal development (Derry, 2013; Miller, 2011, Vygotsky, 2016). Through scaffolded learning experiences, students can expand and advance their understanding, knowledge and individual learning in this zone (Obukkova & Korepanova, 2009; Yung & Tao, 2004; Zuckerman, 2007).

Connectivism, a learning theory developed by Siemen and Downes (Duke, Harper, & Johnstone, 2013) for education in the digital age, focusses on self-directed learning through sharing in a network of people for collective knowledge (Boitshwarelo, 2011; Kropf, 2013). It emphasises the sharing of content sources and spontaneous learning groups to create collaborative knowledge (Bell, 2011; Conradie, 2014; Wang, Chen, & Anderson, 2014). Learning outcomes align constructively with learning, teaching activities and assessments (Black & Williams, 2018; Thota & Negreisos, 2015).

In constructivist and connectivist learning environments, technology supports students to apply their knowledge and learning to analyse, interpret, reason, communicate and solve problems (Attard et al., 2010; Tangney, 2014; Tondeur et al., 2016). Teachers facilitate and guide their students' decisions and allow for risk-taking and learning through doing (Barber & King, 2016; Manning, 2017; Sparrow, Sparrow, & Swan, 2000). Interestingly Johnson (2009) proposed that instructionist-constructivism, which is not extreme or exclusionary, may promote systematic instruction within the context of personal student interest. The next section of this thesis returns to the eight contexts introduced in Chapter One to provide an in-depth exploration of the literature on these.

Trends in EET

Condie and Munroe (2007) cautioned that much evidence on EET resulted from small-scale studies of educational technologies, which were passing trends rather than changing existing pedagogical practices. Such studies were frequently snapshots of early impact in the introduction and implementation of new technologies. Further, such studies do not draw on the requirements of large-scale, methodologically rigorous research.

The resources and practices of EET in teachers' pedagogy to enhance student learning is a rapidly evolving field (Roblyer & Doering, 2014). Technology changes daily, and adopting such changes in EET requires risk-taking (Pöntinen, Dillon & Väisänen, 2017; Hsu, Hung, & Ching, 2013). Teachers and students approach integrating new EET trends in varying ways (Admiraal et al., 2017; Baeten et al., 2010). The availability of EET, the teachers' professional knowledge and self-efficacy of these technologies seem important for pedagogy that integrates current technologies (Gil-Flores, Rodríques-Santero, & Torres-Gordillo, 2017). New EET trends appear to offer teachers opportunities to increase students' learning motivation (Hwang & Wu, 2014; Villagrasa, Fonseca, & Redondo, 2014). These trends may accommodate the following learning nuances: visual (spatial), aural/auditory (musical, verbal/linguistic), kinaesthetic (tactile and physical), logical (mathematical), social (interpersonal), solitary (intrapersonal), and creative and innovative thinking (Higgins, Xiao, & Katsipataki, 2012; Stevenson, Hedberg, Highfield, & Diao, 2015; Stinton, 2010).

Trend awareness can guide strategic planning, inform decisions and address ethical complexities (Buchanan, 2019; Buchanan, Holmes, Preston & Shaw, 2015; Veletsianos, 2016). New trends may provide rich contexts, active and autonomous learning, collaboration, and practical tasks for language development, learning progression, social and social growth. However, embedding change requires teachers to

understand the benefits and challenges of the technologies (Australian Council for Educational Research, 2013; Barber & King, 2016; Taylor & Packham, 2016).

CORE Education (an organisation liaising with the New Zealand Ministry of Education) and the New Media Consortium (an international community of experts in EET innovations) chart trends of EET as resources and practices for the current year (CORE Education 2017c; New Media Consortium, 2017). At the time of my research in 2018, these trends included e-learning management systems (LMS) (Guarino, Santagata, Lee, Cox & Drake, 2020), massive open online courses (MOOCs) and content management systems (CMS) for gathering information and assessing student progress (Doyle, 2015; Dunn, Airola, & Lo, 2013; Hora, Bouwma-Gearhart, & Park, 2014).

My literature research yielded few results on the teachers' evidence-based implementation of specific apps for pedagogy and student assessment. There appear to be neither time nor budget to evaluate apps as they enter the market (Hirsh-Pasek et al., 2015). Consequently, many apps are untested in their content quality, learning value, challenge levels, feedback and collaborative opportunities (Cherner, Dix, & Lee, 2014).

For my research, I narrowed the wide-ranging field of EET trends to focus on eight technologies. The first was portable digital devices with their educational software, apps (Fisher, 2017; Leinonen, Keune, Veermans & Toikkanen, 2016; Wright, 2017) and PowerPoint presentations (Konstantinidis, Theodosiadou, Papachatzi, & Pappos, 2017; Pros, Tarrida, Martin, & Amores, 2013). The second was broadband for teachers and students to interact online through video conferencing for learning across the country (Palvia et al., 2018). The other six were digital games, augmented reality, artificial intelligence, virtual reality, robotics and data analysis software (Hsu et al., 2013; Hwang, 2014; Johns, Troncale, Trucks, Calhoun, Alvidrez, 2017). In Table 1, I identified EET trends at the time of my research and arguments for including these in teaching.

Table 1

Arguments for Teachers of Students who are DHH to Integrate EET Trends in Their Pedagogy

Trends in EET	The argument for integrating the EET
Trends used by teachers at the time of the research	
Apps for targeted learning	Teachers can utilise apps on smartphones and iPads for language development and learning when teaching students who are DHH (Leinonen, Keune, Veermans, & Toikannen, 2016; Miller, 2016; Railean, 2012).
Educational digital games	Game playing principles such as point scoring, competition and playing rules might support learning (Oullet, Romero, & Sawchuk, 2017; Reynolds & Chui, 2016). Digital games, with their visual cues, may enrich teaching and interactive learning practices outside the conventional teaching framework to span various skill levels, learning styles, interests, multiple intelligences, social processes and activities (Aleksić & Ivanović, 2016; Reynolds & Chiu, 2015; Warren, Dondlinger, & Barab, 2008). Digital games might build on students' hearing (aural), spoken (oral) and written (print) skills and usually involve friendly competition to keep students interested (Bouzid, Khenissi, Essalmi, & Jemni, 2016). Games motivate and mediate learning by creating a sense of engagement, relaxation and fun and facilitate students' retention via the drilling of new words (Zainuddin, Chu, Shujahat, & Perera, 2020).
Mobile (portable) digital devices	Portable devices provide ubiquitous access to learning and might empower students to attempt learning feats well beyond current capabilities. Stakeholders in the education system (teachers, students, parents, Ministry of Education, and service providers) might benefit by successfully deploying classroom curriculum through portable devices. However, the fully realised potential of any mobile device in education is entirely dependent on electrical power, network connectivity and user competency (Goundar, 2011; Newhouse, 2014).
Ultra-fast broadband connections	Ultrafast broadband provides for communication and online hypermedia web pages with links to texts, graphics, audio, animation and video clips and the storage of data (Cotter, 2018; Craig & Stevens, 2011; Khaddage, Latteman, & Bray, 2011; Network for Learning Limited, 2015).

Trends in EET	The argument for integrating the EET
	It further allows for wikis, blogs (Akdag & Özkan, 2017; Krish, Ming, Wah, Nambiar & Ya'acob, 2012; Speranza, 2015), host videos, social media (Mahaffey, Kinard, & Daughrity, 2020), and web conferencing (Weeden & Schmitz, 2014).
Trends that teachers had an awareness of but had not necessarily applied at the time of the research	
Augmented reality	Augmented reality enhances real-world experiences (Iannou & Constantinou, 2018; Kiryakova, Angelova, & Yordanova, 2018; Koutromanos, Sofos, & Avraamidou, 2015). It provides students who are DHH with opportunities for immersion and exploration in visual and realistic experiences of concepts previously confined to pictures in textbooks. Further, it enables effective learning processes through participation in a dynamic three-dimensional learning environment with a sense of presence, authentic experience and the potential to empathise with real-life situations. Augmented reality also allows students to immerse themselves in the amplified environment and encourages them to form new informed perspectives and a deeper understanding of the wider world (Alkhatabi, 2017; Pantelidis, 2010).
Communities of learning/kahui āko	Communities of learning/kahui āko are a group of education and training providers that form around the students' learning pathways and work together to help them achieve their full potential. Much consultation occurs through online connections through portals such as Zoom video conferencing (New Zealand Ministry of Education, 2018b).
Database	Data science extracts knowledge and insights to inform future teaching practices (CORE Education, 2017a, 2017b; New Media Consortium, 2017).
Robotics	Educational robotics develop computational thinking skills, an important concept in current education (Constantinou & Ioannou, 2018). They may provide students with opportunities for collaborative teamwork and problem-solving (Kubilinskiene, Zilinskiene, & Sinkevicius, 2017; Papavlasopoulou, Giannakos, & Jaccheri, 2016; Rahman, Krishnan, & Kapila, 2017).

Trends in EET	The argument for integrating the EET
STEM education (Science, technology, engineering and maths) and STEAM education (Science, technology, engineering, arts and maths)	<p>A current trend of education, known by the acronym STEM, utilises technologies to foster interest in connection and collaboration across the school curriculum subjects of science, technology, engineering, and mathematics (Gess, 2017; Harris & de Bruin, 2017; Hunter-Doniger & Sydow, 2016; Levin, 2015).</p> <p>More recently, STEM has embedded the arts to emphasise the creative, critical, and interconnected interdisciplinarity roles. STEAM education solves real-world challenges through hands-on learning activities and creative design. The New Zealand Ministry of Education's recent release of the Digital Technology Curriculum (New Zealand Ministry of Education, 2018a) supports a STEAM approach to education. STEAM anticipates that integrating EET trends and practices will positively influence the pedagogy for student-centred inquiry outcomes (Gess, 2017; Harris & de Bruin, 2017; Hunter-Doniger & Sydow, 2016).</p> <p>At present, students who are DHH in New Zealand may or may not be participating – to various degrees – in the STEAM approach to learning, as this is dependent on their school of enrolment.</p>
Synchronous and asynchronous communication and learning	<p>Synchronous and asynchronous communication for learning allows teachers and students to connect across the country and surpass geographic limitations (Roberts, 2009a, 2009b). Synchronous and asynchronous communication increase the equitable transfer of knowledge. They further increase communication access (Israel, Knowlton, Griswold, & Rowland, 2009; Weeden & Schmitz, 2014). Unlike synchronous learning, which is real-time learning (such as video conferencing), asynchronous learning is time-independent. It allows students to access modules of learning activities in their place and time. (Chai & Lim, 2010; Hrastinski, 2008; New Zealand Ministry of Education, 2015a). The trends of increasingly improved use of high-resolution video have a tremendously positive impact on students who are DHH as this improves the visual quality and clarity of recorded sign language.</p>
Virtual reality	<p>Students can participate in a computer-simulated learning environment with a sense of presence through being part of the virtual environment (Eden, 2008; Eden & Ingber, 2014; Hussein & Natterdal, 2015). The three-dimensional spatial rotation performance of students who are DHH appears to improve through virtual reality (Pantelidis, 2010;</p>

Trends in EET	The argument for integrating the EET
	<p>Passig, Tzuriel & Eshel-Kedmi, 2015). Virtual reality also enhances their ability to perform better in other intellectual skills, flexible and inductive thinking, and sign language skills (Passig & Eden, 2000a, 2000b; Passig & Eden, 2001). Conclusions reached by Power, Power and Horstmanshof (2006) and Valentine and Skelton (2008) suggested that the deaf community is increasingly becoming a virtual community because the Internet has no limitation caused by fixed time and fixed space. Instead, it widens and enlarges their community and interpersonal contact. Also, virtual reality simulations can provide authentic, personalised and customised learning platforms to meet each student's unique learning needs. Virtual reality can encourage creativity, place learning in context, support the learning of skills, and provide potential employability and careers in virtual environments with real-life learning and actual social situations and experiences (Eden, 2008; Hussein & Nätterdal, 2015).</p>
Trends not yet used by teachers at the time of the research	
Artificial intelligence	<p>Artificial intelligence is the scientific field concerned with the creation of intelligent behaviour in a machine. Artificial Intelligence might play an essential role in next-generation student education in providing personalised tutoring and real-time feedback (Arora, 2020).</p>
Avatars	<p>A potentially beneficial trend for students who are DHH is engagement with avatars as figures or icons to represent a particular person with a screen name. At the time of my research, an avatar for teaching New Zealand Sign Language was in development through the University of Auckland and in consultation with the two deaf education centres. However, challenges arise regarding sign language's authenticity through avatars.</p>

Benefits of Integrating EET in the Education Students who are DHH

The environmental, economic, cultural, social, and ethical benefits that technology may have on teaching and learning expectations require critical consideration (Livingstone & Bulger, 2014; New Zealand Ministry of Education, 2020). Traditional bodies of knowledge, such as good teaching, remain a crucial ingredient of the benefits of integrating EET as these technologies in and of themselves do not transform education nor make a difference to learning (Christodoulo, 2014; Cuban, 2018; Solak & Cakir, 2015). Further, the benefits of educational technologies in classroom practices might be exaggerated and cause difficulties for teachers who try to fit their teaching to the unrealistic and unevaluated aspirations of specific technologies (Convery, 2009). Ananiadou & Claro (2009) noted that time and training are required to integrate EET for creating new knowledge and using them beneficially as sources for new ideas and gaining knowledge. An environment of net safety practices is essential for protection against undesirable websites and cyberbullying when using EET to benefit education (McFarlane & Mina, 2018, Slonje, Smith, & Frisé, 2013; Smith, 2015).

I was keen to ascertain if teachers in mainstream education, special education, and those who teach students who are DHH benefit from integrating EET in their pedagogy in similar or different ways to support their students' language development, learning outcomes and social growth. To gain insight into the global evidence of the benefits of teachers' integration of EET in their pedagogy, I searched the literature on studies investigating this practice. I present a sample of these findings in Table 2. The investigation suggests that these technologies appear to contribute to students' education in mainstream schools, special education and the education of students who are DHH. Further, the opportunities provided by EET in special education and the education of students who are DHH also appear to benefit students in mainstream schools.

Table 2

A Sample of Global Research on Teachers' Integration of EET in Mainstream Schools, Special Education, and the Education of Students who are DHH

Continent	Mainstream Education	Special Education and learning for exceptional circumstances	Education of students who are DHH
Australia Oceania	<p>Australia School students need to understand the ethical practices designed to guide their use of emerging educational technologies (EET). Students wish to see policies moved to less restrictive and generic approaches that provide them with opportunities to maximise their education and become ethically responsible users of EET (Brown, 2012).</p> <p>A curriculum needs to exist to educate both digital literacy and computer science from the commencement to the end of schooling (Falkner, Vivian & Falkner, 2014).</p>	<p>Australia Sick students miss essential learning opportunities occurring within the classroom context. EET, such as video conferencing and shared screens, might help students maintain social and academic links with their school during hospitalisation, treatment, and recuperation periods (Wilkie & Jones, 2008).</p> <p>Technology integration might help revitalise science education interest for disengaged young people (Wilson & Boldeman, 2012).</p>	<p>Australia The skills of the students who are deaf or hard of hearing (DHH) should determine the choice of technologies (Potter, Korte, & Nielsen, 2014).</p> <p>New Zealand User-friendly and well-presented computer-assisted language learning resources might support the learning of sign language. However, these resources require self-motivation from learners. Also, learners need to set regular time aside for online study and be willing to learn without human presence for feedback and practice opportunities (Pivac-Alexander, Vale, & McKee, 2017).</p>
Europe	<p>Austria and the Netherlands Makerspaces in schools can promote students' practice-based social innovation and entrepreneurial learning. Here students can turn creative ideas into potential social innovations (Geser,</p>	<p>Czech Republic: Using augmented reality for teaching pupils with special education needs appears to reduce the burden on graphomotorism (the muscular movements used or required in writing). It reduces cognitive stress among</p>	<p>Netherlands Computer-based exercises can support the reading of students who are DHH. The word spelling and visual images in these computer-based reading exercises appear to be more efficient for these students (Reitsma, 2008).</p>

Continent	Mainstream Education	Special Education and learning for exceptional circumstances	Education of students who are DHH
	<p>Hollauf, Hornung-Prahäuser, & Schön, 2019).</p> <p>Greece e-Twinning implements collaborative projects between schools in Europe through dedicated digital platforms and social media. It benefits language acquisition, exchange of learning and professional practices for students and teachers (Kefis & Xanthopoulou, 2019).</p> <p>Netherlands While schools expect EET to increase pupils' motivation, improve their learning outcomes, promote self-directed learning, and enable differentiation between pupils, there were distinct differences in traditional and innovative schools' expectations. Traditional schools mainly used EET to extend and support teaching. Innovative schools used EET to support open-ended activities, with much pupil input (de Koster, Kuipert, & Volman, 2011).</p> <p>Scandinavia Teachers' confidence and self-efficacy in their capabilities to integrate EET in</p>	<p>these pupils (Gybas, Kostolányová & Klubal, 2019).</p> <p>Greece Both teachers and parents can employ EET to adapt education to pupils' needs and abilities (Drigas & Ioannidou 2013).</p> <p>Slovenia Special institutions lack specialised EET. However, the EET that they use appear to be indispensable. Future improvements are required, such as developing the proficiency of teachers and support staff in their integration of EET, replacing old computers, providing adequate didactic software, encouraging the level of EET use at home, and integrating EET in curriculum subjects (Repnik & Krašna, 2008).</p> <p>Turkey EET can support the communication challenges of students with special needs, such as autism. It is therefore of importance that special education teachers understand EET and its uses in special education interventions (Akgül, 2016).</p>	<p>Portugal Research on digital games that affect the learning of students is a demanding task. It requires a multi-disciplinary and collaborative team coordinated by the common goal to create beneficial games for teachers and students in formal and informal educational settings (Costa, Marcelino, Neves, & Sousa, 2019).</p> <p>Students are motivated by educational video games to consolidate and progress mathematics (Neves & Sousa, 2019).</p> <p>United Kingdom Bi-directional connection through EET provide innovative, imaginative and multimodal teaching and learning practices. Teachers can use these technologies to connect to student and parents' home life for enhancing learning at the moment (Gillen & Kucirkova, 2018).</p> <p>Deaf cyberspace (virtual learning environment) can create a bilingual learning context to support student education (Mertzani, 2008).</p>

Continent	Mainstream Education	Special Education and learning for exceptional circumstances	Education of students who are DHH
	<p>their teaching and online collaboration is essential (Hatlevik, 2017).</p> <p>United Kingdom EET need to support the varied contexts in which people live their lives and improve conditions (Mansell, 2010).</p>		
North America	<p>United States of America EET positively impacts the alignment of parental and family involvement with the student and the school for school-home communication and improving student outcomes. Cultural, socioeconomic and other factors influence the adoption of technologies for school-home communication (Heath, Maghrabi, & Carr, 2015).</p> <p>Eight factors to successfully leverage technology for school education improvement include a vision for its implementation, distributed leadership, technology planning and support, school culture, professional learning, curriculum and instructional practices, funding, and partnerships (Levin & Schrum, 2013).</p>	<p>Alaska New technologies impact the traditional Alaskan ways of knowing and learning. Rural communities seek to join the digital revolution while simultaneously attempting to preserve their own identity, culture and social context (Page & Hill, 2008).</p> <p>Health-focussed interventions utilising digital technologies hold promise for adolescents and young adult American Indians and Alaskans. These technologies can eliminate geographic barriers to deliver information that reflects their unique worldviews and social contexts (Saboto, 2019).</p> <p>Canada EET can serve children with special needs, families, teachers, and health care providers who live in rural communities (Roberts, O'Sullivan & Howard, 2005).</p>	<p>The United States of America and Canada Limited research on the effects of EET intervention in the education of students who are DHH prohibits the establishment of indicators and an evidence base for determining the results of such practices (Beal-Alvarez & Cannon, 2014).</p> <p>United States of America Augmented reality tools give access to augmented reality projections. Augmented reality in the education of students who are DHH, although still in its infancy, can potentially provide learning support (Parton, 2017).</p>

Continent	Mainstream Education	Special Education and learning for exceptional circumstances	Education of students who are DHH
	<p>The teachers' experiences with EET significantly influence their integration of this in the classroom. Access to technology, the availability of quality technical support, frequency of technology use, confidence and comfort result in greater integration of EET (Liu, Ritzhaupt, Dawson, & Barron, 2017).</p> <p>EET influences the context of learning mathematics. The interactions amongst students, teachers, tasks, and technologies can bring about a shift in teacher empowerment to the students as the generators of mathematical knowledge and practices (Olive et al., 2010).</p>	<p>United States of America</p> <p>Providing EET requires extensive collaboration with students, parents, teachers and support staff. Meeting IEP goals through online learning poses challenges. Therefore, moving to a technology environment requires thorough consideration regarding practice, policies, and research (Carter & Rice, 2016).</p> <p>Technologies can improve learning in rural schools without requiring students to abandon their commitment to local community priorities. Adequate technology and professional preparation are predictive of technology integration measures in terms of the sophistication of technology use. Providing EET to rural teachers is likely to improve their ability and willingness to integrate these into instruction (Howley, Wood, & Hough, 2011).</p> <p>Assistive technologies in universal design for learning can support students with learning disabilities in mainstream secondary school classrooms (Messinger-Willman & Marino, 2010).</p>	

Continent	Mainstream Education	Special Education and learning for exceptional circumstances	Education of students who are DHH
		Significant variations in the reasons, knowledge base, equity and inclusion of technologies for children with special needs exist (Pandya & Ávila, 2017).	
South America	<p>Brazil Online distance mathematics education in Brazil is an evolving field. Additional studies are needed to understand better its essential components (Maltempi & Malheiros, 2010).</p> <p>Chile Digital skills and literacy are required to integrate and participate in an increasingly technology-rich society fully. The essential factors in developing digital skills are having access to a computer at home, linguistic capital, socioeconomic status, and years of experience using a computer (Jara et al., 2015).</p> <p>School policies and school culture have a vital role in preventing cyberbullying by providing and supporting a protective resilience model (Varela, Zimmerman, Ryan, & Stoddard, 2017).</p>	<p>Brazil Children with challenges may use web applications installed on smartphones or tablets to communicate and interact with their counterparts. These technologies allow for repeating actions as often as necessary to test students' knowledge (Manrique, Kozma, Dirani, da Silva, & Frere, 2016).</p> <p>Peru EET, such as mobile tools, make it possible to increment the mathematical and language skills of students who have Downs Syndrome (Villasante, Poma, Gutierrez-Cardenas, & Rodriques-Rodriques, 2019).</p>	<p>Columbia EET represent game-changing opportunities for access to inclusive education as they help overcome the obstacles and limitations present in the traditional education systems (Flórez-Aristizábal et al., 2019).</p>

Continent	Mainstream Education	Special Education and learning for exceptional circumstances	Education of students who are DHH
	Ecuador, Columbia, and Chile There is a need for an improved understanding of the relationship between cultures and the degree to which teachers integrate technology in education (Salinas, Nussbaum, Herrera, Solarte, & Aldunate, 2017).		
Asia	Indonesia Technology might provide equalising and equity in education for all. Massive open online courses (MOOCs) have the potential to engage all relevant parties in e-learning (Majid & Fuada, 2020). India Integrating EET is an increasing necessity for learner-centric and inclusive education and for reducing the digital divide. Also, positive perceptions are essential in helping teachers try new technologies and adopting these in their teaching. Furthermore, the board of trustees and school leadership's input influences teachers' perceptions of EET integration (Singhavi & Basargekar, 2019). Singapore, Hong Kong, Taiwan and Beijing	China Rapid developments in EET for in-person contact creates learning opportunities in special education. Through these Internet technologies, there are greater expectations for communication, sharing, analysis and reflection. Internet technologies, in turn, facilitate the students' holistic development and social inclusion (Sin & Lui, 2013). Dubai Variables such as the relevance of EET, access to these, self-efficacy, time and a positive attitude impacted the use of EET in special education (Siyam, 2019). Malaysia EET can positively promote education and contribute to the eradication of poverty through socio-economic development programs. Educational and socio-	Israel The Internet provides students who are DHH with a means of visual communication through text and images providing empowerment, greater equality and access to information (Barak & Sadovsky, 2008). Iran (Tehran) and South Australia (Adelaide) Students who are DHH reported a positive impact of social media on their learning in the form of increased interaction, learning motivation, support and feedback. Research on the effects of social media on DHH of hearing remains an under-explored area of study. Further, there are universal challenges raised in research around the effectiveness of EET. These challenges include personal privacy protection, time management, inappropriate content of software and Internet sites, perceived isolation, and parental resistance to adoption (Toofaninejad, Zavaraki, Dawson, Poquet, & Daramadi, 2017).

Continent	Mainstream Education	Special Education and learning for exceptional circumstances	Education of students who are DHH
	<p>Planning and implementing official policies on EET require dimensions on infrastructure, curriculum integration, student learning, teachers professional learning, leadership and capacity building (Kong, Looi, Chan, Huang, & Cheah, 2014).</p> <p>Taiwan Vision from leadership is necessary for the effective integration of technologies by teachers in their teaching. Three other leadership constructs that support teachers' integration of EET in pedagogy are providing professional learning, infrastructure support, evaluation and research (Chang, Chin, & Hsu, 2008).</p>	<p>development initiatives inclusive of EET can maximise the inclusion of the underprivileged students in the mainstream system and enable them to change their destiny (Aftab & Ismail, 2015).</p> <p>Oman Teachers of special education generally indicated positive attitudes towards using EET in their teaching. The type of disability did not significantly affect teachers' attitudes towards technology (Hassan & Mohamed, 2018).</p> <p>Saudi Arabia Extensive use of EET supported the word processing and writing inclusion of learners with special education needs (SEN) of all ages. However, to achieve this, there is a need to adapt teaching for students through a pedagogy that integrates technology (Abed, 2018).</p>	
Africa	<p>Algeria EET may support students in autonomous learning, raise education standards, and improve teaching and learning quality. They may remove barriers to learning and participation, provide equity and inclusion, and</p>	<p>Ghana Those involved in delivering special education needs (SEN) recognise that EET can contribute to the learning processes of people with disabilities. EET can contribute to inclusive education and ensure parity of access to the</p>	<p>Nigeria Barriers to language access impact negatively on the learning achievements of students who are DHH. EET can assist the computer and project-based learning of these students by motivating and stimulating their interest in subjects such as the sciences (Adigun, 2020)</p>

Continent	Mainstream Education	Special Education and learning for exceptional circumstances	Education of students who are DHH
	<p>prepare for employment. Teachers' professional learning of EET is essential for its purposeful implementation (Boutkhil & Benachaiba, 2012).</p> <p>Ghana TPACK has the potential to develop the technology integration experiences of pre-service teachers (Agyei & Voogt, 2012).</p> <p>Developed or developing countries and geographic locations require different models for implementing EET. User satisfaction is necessary for the effective integration of EET in education. (Korateng, Sarsah, Kuada, & Gyamfi, 2020).</p> <p>Kenya Integration of EET in schools depends on its policy and vision rather than the cost of technology infrastructure or the teachers' technology skills (Francis, Ngugi, & Kinzi, 2017).</p> <p>South Africa EET can motivate students' performance. They are valuable tools for teachers to enhance teaching and</p>	<p>curriculum. EET can improve pedagogy, support the control of children with behavioural difficulties, and enhance the social participation of persons with SEN. Governments across Africa need to take decisive action to ensure that experiences with technologies enable those with SEN to achieve their full potential in special schools or mainstream education (Nkansah & Unwin, 2010).</p>	<p>Tunisia The increase of EET in education and the development of sophisticated environments to improve teaching and learning has not necessarily accommodated students who are DHH. There are relatively few technology tools dedicated to these students' education due to the difficulty of creating content in sign language (Jemni & Elghoul, 2008).</p>

Continent	Mainstream Education	Special Education and learning for exceptional circumstances	Education of students who are DHH
	<p>learning and enable student-centred inquiry (Louw, Rankhumise, & Maimane, 2019).</p> <p>Sub-Saharan Africa Teacher training is required to qualify teachers to include EET in primary education (Leach, 2008).</p>		
Antarctica	<p>As no one lives permanently in Antarctica, there is no relevant research on the use of EET in teaching for this continent (CoolAntarctica.com, 2020).</p>	<p>There are two small schools on the Antarctic Peninsula (at the Argentinian Esperanza Base and the Chilean Presidente Eduardo Frie Montalva Base). The parents of these children work as scientific or support teams at these bases. They stay for anywhere between three to eighteen months. (CoolAntarctica.com, 2020).</p>	<p>No literature found.</p>

Acquisition of digital skills

The acquisition of digital skills develops and progresses through stages of competence in learning new skills (Bers, 2010; Spencer, 2015). Parsons (2016) and Spencer (2015) refer to the three stages identified by Wenmoth (2015) of attaining digital development skills for teaching and learning. These three performance levels of expertise are digital proficiency, digital literacy, and digital fluency (see Figure 2).

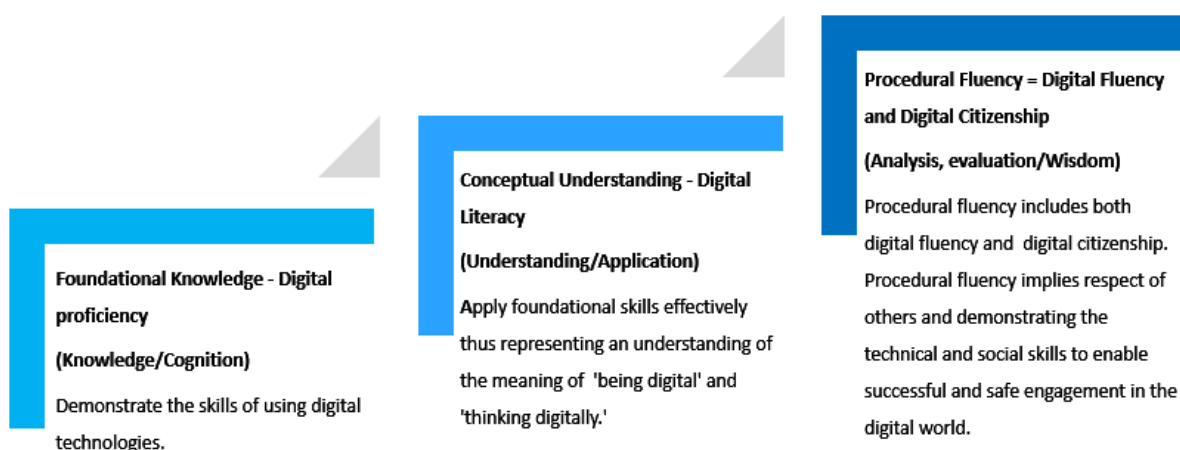


Figure 2. Stages of digital development (adapted from Wenmoth, 2015 in Parsons, 2016 and Spencer, 2015. Reproduced with permission of the author under the Creative Commons License).

Wenmoth (2020) explains an additional digital development skill as being digital agency to support the learner's choice and options of what transpires in the learning. The progression of digital competence, literacy, fluency, and agency highlights the significance of developing the skills, knowledge, and capabilities to fully participate in the digital world (Wenmoth, 2020).

Digital proficiency.

Digital proficiency commences the measure of how effectively the individual or the school organisation demonstrates skills in EET and engages with these. Benner (1982) conferred that the Dreyfus model suggests that there are five levels of proficiency

to pass through in the development of a skill. These levels are that of a novice, advanced beginner, competent, proficient, and an expert user. Digital proficiency commences with the progression of participating in, executing and leveraging technology to improve communication and education (Bers, 2010; Saubern, Urbach, Koehler, & Phillips, 2020).

Digital literacy.

Bers (2010) describes digital literacy as a new form of scholarship requiring unique techno-procedural demands and cognitive skills. This literacy involves using EET in the home, at school and in the workplace to investigate, create, communicate and participate in society (Jose, 2016; Reinsfield, 2018; Thomson, 2015). Digital literacy also concerns attitude and the ability to identify, access, manage, integrate, evaluate, analyse and synthesise digital resources (Khamprem & Boonmoh, 2019; Knezek & Christensen, 2016). It also assists in creating new knowledge and communication with others through constructive social action and reflection (Martin, 2005; Osterman, 2012).

Digital fluency and digital citizenship.

Digital fluency requires the ability and readiness to judge the effectiveness of current and future technologies for specific uses and integration to achieve particular learning outcomes (Reinsfield, 2018). It requires teachers to move beyond conventional ways of using EET for lesson preparation, management and administrative tasks to create something new with these technologies (Palak & Walls, 2009). Digital fluency also means having the skills and knowledge to make informed decisions on technology use and practices. Further, digital fluency requires competence in finding and critically evaluating online information for the students' language development, learning progression and social growth (Bartlett & Miller, 2011; Donahoo & Velasco, 2016).

Digital citizenship implies understanding the rights and responsibilities of inhabiting cyberspace. Such citizenship allows participation in educational, civic, social, cultural, economic and environmental online opportunities (New Zealand Ministry of Education, 2019a). Being digitally fluent and attaining digital citizenship are rapidly emerging as critical for workforce preparedness (Gogia & Pearson, 2018).

Teachers' Integration of EET

As seen in Chapter One, teachers consider that the integration of EET can benefit their pedagogy when teaching students who are DHH and therefore have various motivations for including them. Such reasons may involve preparing students for the global information society, future work placement, participating in the same way as their hearing peers (Consortium for School Networking, 2019; New Zealand Government, 2017) and seeing students meet the age-appropriate language development, learning progression and social growth goals (New Zealand Ministry of Education, 2007b). I discuss five motives: language access; provision for equity, diversity and geographical distribution; student-centred inquiry; social growth; and EET for assessments.

Language access.

Language is essential for communication, learning, knowledge and social growth. All aspects of living require language for emotional reasoning, problem-solving, professional and leisure activities, and knowledge acquisition through reading, writing and maths (Luckner, Muir, Howell, Sebald, & Young, 2005; Luft, 2017; Marschark et al., 2015). Language is indispensable for memory and understanding of concepts, including abstract ideas (Kang, Heo, & Kim, 2011; Lidström & Hemmingsson, 2014; Snoddon, 2010). The circumstances of DHH create barriers to language access (Ching et al., 2018; Goleman, 2000). Therefore, these students require intensive intervention, specialist

support, and substantial resourcing for their functional use of language, expression, and listening skills (Knoors & Marschark, 2015; Ling, 1978; McDonnell, 2014).

The education of students who are DHH prioritises access to vocabulary and building their lexis for effective communication and literacy (Deaf Education Aotearoa New Zealand, 2010). The two primary communication modes in these students' education are visual communication through sign language (Evans, 2004; Perniss, Özyürek, & Morgan, 2014) and oral/aural communication (Andrews & Rusher, 2010). Oral refers to the mouth and speaking, while aural refers to the ear or hearing (Ling, 1978). Effective sound amplification may support language, learning, and social performances of students who use oral/aural communication (Ching & Hill, 2007). In New Zealand, teachers may apply sign-supported English to explain word structure and grammar when teaching reading (New Zealand Ministry of Education, 2015a, 2015b).

Language barriers and language nuances may cause challenges in communication access. These challenges place students who are DHH at risk of not developing the necessary skills for appropriate interactions, conversations, making friends and dealing with conflict. Students who are DHH face challenges in acquiring writing and language skills, phonological coding skills (sounds/phonemes, syllables and words) necessary to develop fluency in phonics (the process of mapping word sounds to written letters) and comprehension of vocabulary for reading (Bullard & Luckner, 2013; Harris, Terlektsi, & Kyle, 2017; Scheetz, 2012). Vocabulary limitations affect communication and create obstructions, which impede literacy. Therefore, teachers support these students in developing their language for attaining independence, satisfying relationships, expressing their own needs, and successfully advocating for their rights in different settings, situations and a sound orientated world (Alqraini, 2018; Bullard & Luckner, 2013).

EET allow for reading written information at the user's tempo and provide unlimited re-reading options (Elsendoorn, 2002). Images, sound, movement, animation and simulations provided by EET may make language and abstract concepts concrete and bring these ideas to life (Kubilinskiene, Zilinskiene, & Sinkevicius, 2017; Papavlasopoulou, Giannakos, & Jaccheri, 2016; Rahman et al., 2017). My literature investigation affirmed that these students' teachers need to consider how best to include EET in their pedagogy to achieve their language development goals.

Equity, ethnic and socio-economic diversity and geographical distribution.

Scheetz (2012) pointed out that “emerging educational technologies have begun to level the playing field, providing individuals who are deaf and hearing alike with access to the information highway” (p.47). Equitable access to positive learning outcomes in language, cognitive, and social growth; acknowledgement of ethnic socio-economic diversity; and geographical distribution cause challenges for the education of students who are DHH (Benedict & Sass-Lehrer, 2007; Rotherham & Willingham, 2009). Further, the emphasis on equitable access to EET was vital for addressing the four research questions (Christensen, 2010; Fitzgerald & Associates, 2010).

As DHH is a global phenomenon, students represent diverse ethnicities and a broad spectrum of high, middle or low socio-economic status, education, social class, occupation and income. Teachers, therefore, require awareness of various cultural practices (Cormack & Robson, 2010; New Zealand Ministry of Education, 2009, 2013c; Webber, McKinley, & Hattie, 2005). Inclusivity provides a positive classroom environment with supportive, flexible and relevant pedagogy adjusted to the students' diverse characteristics, developmental levels, and individual needs (Mitchell, 2014; United Nations Educational Scientific and Cultural Organisation, 2000, 2001).

Students who are DHH represent a diverse and geographically dispersed population, as these conditions occur across all cultures, locations, socio-economic constructs, ages and gender. Therefore, both government and community organisations need to provide equitable funds for EET to support language, learning, and social growth, to enable these students to have the same technology benefits as the rest of the community (Hartnett, 2017; McLeod, Waite, Benavides, Pittard, & Pickens, 2011; Power & Power, 2010). Table 3 indicates initiatives supporting equity and fair distribution of services and resources in the education of students who are DHH.

Table 3

*Support Initiatives for Equitable Education for Students who are DHH***New Zealand Sign Language at School project (NZSL@School)**

The New Zealand Sign Language at School (NZSL@School) project supports students who need New Zealand Sign Language at the school they attend. The aim is for these students to achieve educationally and socially at the same level as their hearing peers (Fitzgerald & Associates, 2010; New Zealand Ministry of Education, 2014b, 2018c).

World Federation of the Deaf

The World Federation of the Deaf is an international organisation representing 123 countries. It improves the status of sign languages, advocates for better education for people who are deaf, improves access to information and services, and improves human rights for these people in developing countries (Scheetz, 2012).

Right to education, rights of the child, right to sign language and equity

The right to education (Office for Disability Issues, 2016; United Nations Educational Scientific and Cultural Organisation, 1994, 2000) and the rights of the child (Shier, 2001; United Nations Human Rights Office of the High Commissioner, 1989) declare the philosophical and empirical recognition of social justice for children. Other equity opportunities include breaking down communication barriers through the right to sign language (Human Rights Commission, 2013; Humphries et al., 2013; Office for Disability Issues, 2016), equitable and inclusive education (Mitchell, 2014; New Zealand Ministry of Education, 2018b; Powell & Hyde, 2013), and timely intervention from professionals (Scheetz, 2012).

Ethical and inclusive leadership

The practice of ethical and inclusive leadership requires an equitable collective leadership process to include teachers, students, and parents in school activities and advocate for all individuals and groups (Lommen, 2016; Ryan, 2007).

Integration of educational technologies to support, extend and enrich learning

The integration of EET support access equity and social justice in learning. They can extend and enrich learning processes (Capuano et al., 2011; Nikolarazi & Vekiri, 2012; Ronan, 2018) and create equitable opportunities to maximise, enhance and extend students' autonomy and social growth (Granshaw, 2015; Guerriero, 2013). EET can enrich learning presentations, demonstrations, drills and practices, interactions, collaboration and social connectivity (Guerriero, 2013). In the education of students who are DHH, these technologies support learning outcomes, which can lead to more equitable, interactive and active participation in learning (Hashim, Tasir, & Mohamad, 2013; Scherer et al., 2015).

Student-centred inquiry.

The New Zealand curriculum focusses on student-centred inquiry to achieve five key competencies considered essential for sustained lifelong learning and active participation in society (New Zealand Ministry of Education, 2007b). These key competencies are thinking; using language, symbols, and texts; managing self; relating to others; and participating and contributing (New Zealand Ministry of Education, 2007b). Therefore, teachers of students who are DHH might be motivated to integrate EET as resources and practices in their pedagogy to make learning participatory, positive and effective for the individual students' learning requirements (Ford & Kent, 2013; Zuber-Skerrit, 2015, 2018).

The occurrence of DHH obstructs the language and communication access required for student-centred inquiry. However, like all students attending state schools in New Zealand, student-centred inquiry lies at the foundation of the educational philosophy for students who are DHH (Granshaw, 2015; New Zealand Ministry of Education, 2007b). Students construct learning and meaning by investigating a topic, idea, or issue through inquiry. Inquiry enables students to learn via curiosity, discovery and collaboration rather than through the presentation of facts or direct. Through the pedagogy of inquiry, students pose thoughtful questions, make sense of information, and develop new understandings about a topic and their world. Student-centred pedagogy requires teachers to inquire consistently into the impact of their teaching on their students' learning (New Zealand Ministry of Education, 2007b). The student-centred inquiry develops autonomy, a love of learning, and cultivates the skills and attitudes needed for self-directed lifelong learning (Wang, 2011; Zhao, 2015).

As such, EET may provide essential resources for the student-centred inquiry process if teachers continue to combine and strike a balance between known and

traditional pedagogy with the best of contemporary twenty-first-century learning opportunities (Greenlaw, 2015). Çubukçu (2012) and Veletsianos (2016) expanded on this, explaining that integrating these technologies in the learning process facilitated engagement and heightened interest, thus improving the students' skills and learning outcomes. EET provide students with new ways to interact with ideas, data and computations. Further, Crawford (2010) and Crook and Sharma (2013) found that EET as resources and practices assist students' progression when applying higher-order thinking skills to creative problem-solving and help them make sound judgements. Ferguson (2009), Johnson et al. (2017) and Ramoroka and Sebola (2017) held the view that EET are resources to support the delivery of high-quality education. Concerning EET in the education of students who are DHH, Becta (2005), Capuano et al. (2011) reported that integrating these technologies fosters their technical skills, interests, higher-order thinking skills and cognitive abilities. Similarly, Nikolarazi and Vekiri (2012) and Ronan (2018) recognised that these technologies support and connect learning to real-world situations, enrich students' understanding, and provide a scaffold to develop concept formation and motivation for learning.

Social growth.

The development of academic and social skills is essential in student education (Rutledge & Cannata, 2016). Social growth, and the cognition necessary to understand social situations, can impose more significant challenges for DHH students because language and communication barriers may lead to a lack or delay of social experiences and social learning (Antia, Stinton, & Gaustad, 2002; Scheetz, 2012). Teachers may, therefore, be motivated to utilise the opportunities that EET provide to develop the social skills of their students. In the next section, I explore how teachers accomplish this by expanding the social world of their students, creating social opportunities beyond the

classroom, providing for age-appropriate social growth and understanding the role of social competence and emotional intelligence.

Expanding the social world of students who are DHH.

Teachers increasingly expand their students' social world and networks as they link them through the Internet with their peers across the country in urban, rural or remote locations (Belcastro, 2004; Cela, Sicilia, & Sánchez, 2014; Stredler-Brown, 2012). In-person contact through technology accommodates the visual communication requirements of New Zealand Sign Language. This development has profoundly impacted students who are DHH. In-person contact through technology enables communication through speech, sign language and script as time, location, and space no longer cause restraints (Lang, 2011). Such connection creates teaching opportunities, communication, social growth, role modelling of New Zealand Sign Language and English, building relationships, and enlarging the known community (Crawford, 2007; Marschark et al., 2015; Rajesh, 2015). EET thus create opportunities for teachers to develop and promote students' social competence through peer socialisation by participating in relationships with appropriate conversational language, social coaching and social problem-solving (Antia et al., 2002; Duncan-Howell, 2010; Valentine & Skelton, 2008). In summary, a motivation of including these technologies might, therefore, be to encourage increased levels of social engagement through interaction and co-construction in the classroom for personalised student-centred inquiry and social growth (Rawlins & Kehrwald, 2014; Scherer et al., 2015; Veletsianos, 2016).

Creating social engagement beyond the classroom.

Students can join or create communities through student-centred inquiry, which extend beyond the classroom (New Zealand Ministry of Education, 2007b; Newhouse, 2014; Sharma, Gandhar, Sharma, & Seema, 2011). Bingimlas (2009) and Ertmer and

Ottenbreit-Leftwich (2010) defined how EET might help students to equip themselves with competencies for their current world. These competencies include the knowledge and skills necessary to assimilate and participate in contemporary and future society (Barber & King, 2016; Burgon, Hipkins, & Hodgins, 2012; Lidström & Hemmingson, 2014). These skills, also known as 21st-century skills, include critical thinking and problem-solving skills, communication skills, collaboration skills, and creativity and innovation skills (Germaine et al., 2016).

Despite these identified benefits for students who are DHH, teachers remain central to the effective adoption and integration of these technologies. These benefits of EET in teaching include enhancing pedagogy to increase students' learning engagement, creativity, collaboration and connection with their peers and progress towards higher-order thinking (Boschman, McKenney, & Voogt, 2015; Hargreaves & O'Connor, 2018). Other motivations for including EET in pedagogy are to offer students a self-directed learning process and reflective practices that lead to action and self-evaluation for improvement (Education Review Office, 2016a, 2020).

Age-appropriate social growth.

Teachers of students who are DHH intend to achieve age-appropriate levels of language development, learning progression and social growth for their students. Social growth emanates from a unique pedagogy with additional requirements to their hearing peers (New Zealand Ministry of Education, 20011a; 2015a). Learning critical thinking is necessary for these students' character education, understanding values and moral reasoning (Easterbrooks & Scheets, 2004). Antia et al. (2011) concluded that good classroom communication and participation in extracurricular activities are both areas where intervention is possible and appear to influence social outcomes positively. EET may provide a supportive role in the social growth of these students.

Social competence and emotional intelligence.

Social competence includes emotional intelligence, which is the capacity to consider others and control the expression of emotions (Antia et al., 2002; Russle, Hosie, Sperandio, & Mustard, 2015). Bandura (1971) highlighted the importance of observing and modelling behaviours, attitudes, and emotional reactions as part of social learning. Social learning concerns human behaviour in terms of a continuous reciprocal interaction between cognitive, behavioural, and environmental influences (Bandura, 1977; Deming & Johnson, 2009; Harinie, Sudiro, Rahayu, & Fatchan, 2017).

Emotional intelligence includes handling interpersonal relationships judiciously and empathetically (Chilton, Mayer, & McCracken, 2019; Hughes & Leekam, 2004). Goleman (1995) identified the five components of emotional intelligence: self-awareness, self-regulation, motivation, empathy, and social skills. The New Zealand Curriculum (New Zealand Ministry of Education, 2007b) defined social growth through emotional intelligence as exhibiting a correct balance of personal and social competencies in self-awareness (understanding of oneself) and self-management (taking responsibility for decisions, self-efficacy, ability to advocate for oneself, becoming resilient and assertive; and developing the skills and competencies for comfort with oneself through self-management and self-control).

Woolfe, Want, and Siegal (2002) suggested that students who are DHH are at risk of delays in their social development. The primary cause of their social growth delays is the lack of access to environmental conversations for incidental learning and difficulty communicating daily routines. These factors create challenges when discussing thoughts, beliefs and intentions among DHH children who lack adequate language. The exposure of these children to natural and accessible communication and a strong language foundation from an early age supports them in not suffering social growth delays (Chilton

et al., 2019; Peterson, 2016; Schick, De Villiers, De Villiers & Hoffmeister, 2007).

Luckner (2016) described social competence for students who are DHH as including social awareness (understanding others, sharing, engaging and interacting easily in conversation with people individually and in groups such as peer groups). Social capability also includes relationship management such as managing others; developing empathy through the ability to adapt to and read social contexts, and acting appropriately for these contexts; understanding etiquettes and manners; being associative, cooperative and collaborative in participation; and having skills for requesting, offering, accepting and refusing assistance appropriately (Luckner & Movahedazarhouli, 2019) and clarity on character values (Easterbrook & Scheetz, 2004).

Assessment.

Like mainstream students, assessing the learning of students who are DHH allows for accurate judgement on what students know individually or collaboratively (Education Review Office, 2016a). Assessments monitor and improve school effectiveness and instructional practices, to maximise student learning (Education Review Office, 2016a, 2016b). Performance assessments involve students in activities that require them to demonstrate mastery of specific skills or the ability to create products that meet particular standards of quality (Chróinín & Cosgrave, 2013; Low & Fowler, 2019; Pino-Pasternak, Basilio, & Marisol, 2013).

Assessment of student-centred inquiry, project-based learning, cross-curricular learning, and play-based learning all require excellent curriculum knowledge. Such assessment further requires constant attention to student actions so that teachers can notice, recognise and respond to the needs of the students in their care. Assessments can provide a range of data to inform program planning and decision-making for keeping track of progression to help evaluate, guide and account for students' learning (New

Zealand Ministry of Education, 2019b). In the context of students who are DHH, those who are deaf require the option of the assessment to be presented in sign language to accommodate their linguistic background (Cawthon et al., 2011). Students who are DHH further require comprehensive direct assessments to profile their levels of oral and written language (Nelson & Crumpton, 2015).

Roblyer and Doering (2014), Rowe (2000), and Ruggiero and Mong (2015) indicated that EET could assist teachers' assessments and evaluations on the educational performance of student learning. Technologies for interpreting norm and criterion-referenced assessments support the growing demands for data to communicate findings that indicate standards and benchmarks (Sharratt & Fullan, 2013; Sharratt & Planche, 2018). Further, EET provide a range of assessment methods, including checklists, questionnaires, observations, pre-testing and post-testing, quizzes, sociometric tools and e-portfolios (Haralabous & Darra, 2019; Hooker, 2019).

Education of Students who are DHH

The New Zealand Ministry of Education and the New Zealand School Trustees Association inform the school boards/poari of trustees of the national alignment and strategic direction for education (New Zealand School Trustees Association, 2018). The board of trustees for students who are DHH is one of these boards. As boards of trustees are Crown entities, they are responsible for the state and state-integrated school's/kura's performance and achievement of their culturally diverse student populations (New Zealand Ministry of Education, 2007a, 2013a, 2013b). Boards set the vision for schools and ensure that they comply with and meet all relevant policy and legal requirements (New Zealand School Trustees Association, 2018).

Boards develop an annual charter that articulates its educational service delivery, vision, mission, purpose, strategic direction and path for integrating EET (Combined

Board of Trustees, 2019). The Board's strategic long-term plan outlines the school's philosophy, approach, vision, aims, objectives, goals and targets. This strategic plan, presented in the school charter and annual plan, forms the basis for all school/kura decision-making (New Zealand School Trustees Association, 2018). Currently, the two New Zealand deaf education centres are separate service providers under one Board of Trustees. However, effective from 20 July 2020 (first day of the third term), the two deaf education centres merge to form one national school provision and network of services for students who are DHH in New Zealand (Franks, 2019; New Zealand Ministry of Education, 2018b). The purpose of this merger is to bring consistency in education and equity of services and resources. A further objective is to strengthen students' education and lift their achievements and life skills (Hipkins, 2019).

EET in the context of education for students who are DHH.

The introduction of new technologies requires the development and learning of new signs to name these technologies. The deaf staff (usually a DHH leader or New Zealand Sign Language tutor) introduces the new signs to the hearing staff once the deaf community agrees that it is suitable for adoption. For signs to be recognised in the New Zealand Sign Language dictionary, these first need endorsement from the School of Linguistics and Applied Languages Studies (Te Kura Tātari Reo) at Victoria University in Wellington. Identified challenges to learning in the DHH context tend to focus on access to communication (Bruce & Borders, 2015; Kurkova & Scheetz, 2016; Pizzo, 2016). Further challenges relate to collaboration, equity, inclusion in school activities and learning (Ryan, 2012), and the diversity of the student population (Antia et al., 2002; Ayantoye & Luckner, 2016; Isakovic & Kovacevic, 2015). While EET may partially address some of these issues, teachers of students who are DHH face limitations when integrating EET in their pedagogy. These limitations relate to the teachers' ability to use

various technologies and the flexibility required to reconfigure their pedagogy to adapt to new circumstances or resources (Ertmer, 2010; Livingstone, 2012).

Social growth.

The Education Review Office (2015a, 2015b) and Ryan (2007) recognise that it is essential for students to feel included in a facilitative learning environment, experience a supportive school community, and receive quality teaching and education. Improving the language, expressive and receptive communication skills of students who are DHH is critical for their successful inclusion in the mainstream school setting (Ayantoye & Luckner, 2016; Alasim & Paul, 2018; Isaković & Kovačević, 2015). Teachers can help facilitate the students' shared understanding and positive inclusion in the school environment and student activities (Fellinger, Holzinger, Sattel, & Laucht, 2007; New Zealand Ministry of Education, 2007b; Salter, Swanwick, & Pearson, 2017). Although some research results showed adverse social effects for these students in mainstream education settings, the findings of Antia et al. (2011) indicated that excellent classroom communication and extracurricular participation, as means of intervention, appear to influence social outcomes positively. Power and Hyde (2002) likewise affirm that with appropriate support and targeted programs from mainstream class teachers and itinerant teachers of students who are DHH, most appear to adjust suitably to the learning and social interactions within the school.

The two New Zealand deaf education centres address aspects of social needs through Sports Days, Keep in Touch (KIT) Days, and Language Days. These days are opportunities for students from various geographical locations to meet, learn, socialise and share New Zealand Sign Language. Besides improving communication for language and reading skills, teachers can include strategies for these students to use sign language interpreters effectively to participate in classroom discussions, repair communication

breakdowns, and to self-advocate (Antia, Jones, Reed, & Kreimeyer, 2009; Marschark, Sapere, Concertino, & Seewagen, 2005; Schick, Williams, & Kupermintz, 2005).

Circumstances affecting the education of students who are DHH.

The history of education for students who are DHH emphasises the development of pedagogy to support communication skills, language proficiency and literacy (Easterbrooks et al., 2015; Scheetz, 2012; Woolsey, Harrison, & Gardner, 2004). Various circumstances create diversity and uniqueness in this student population, which in turn affect their education and may cause them to be at risk of achieving lower than their potential (Antia et al., 2009; Hendar & O'Neill, 2016; Truax, Foo, & Whitesell, 2004).

Circumstances that affect learning may derive from the student's cause of hearing loss, hearing level, communication style, comprehension and expressive abilities, and age of diagnosis of the hearing loss (New Zealand Ministry of Education, 2016). Other circumstances result from the age and stage at which auditory aiding occurred, modes of communication, use of amplification devices and type of amplification device applied to aid audition. Added circumstances may result from additional physical and holistic needs, home language, home culture, refugee circumstances, and sense of identity (Office for Disability Issues, 2016).

Bowen (2016) concluded that while the educational context for students who are DHH is similar to that of other bilingual learners, it is very different in some crucial ways. A primary difference for these students involves establishing sign language as their native or natural first language (most of them being born to hearing parents) and becoming literate in social speech, inner speech and written text. From this perspective, spoken language is the secondary language to acquire either after or at the same time as the native language. Learning in their first language allows students who are DHH a

sense of belonging and creates meaningful academic, cognitive and social experiences for them (Humphries et al., 2013; Paul, 2018; Swanwick, 2016).

Individualised education.

The education of New Zealand students who are DHH utilises an inclusive, individualised approach to learning (New Zealand Ministry of Education, 2016). This approach provides services for the child from agencies and teachers who collaborate with the family/whānau to support their child's education (Laing, 2006; New Zealand Ministry of Education, 2005; New Zealand Ministry of Education, 2019b). Services include two closely collaborating deaf education centres, one located on the North Island (Kelston Deaf Education Centre) and one on the South Island (van Asch Deaf Education Centre). Other services include Advisers on Deaf Children, the Northern and the Southern Cochlear Implant Programs, audiologists of the District Health Board, and support services for family/whānau (New Zealand Ministry of Education, 2018c).

Bronfenbrenner's bioecological systems theory of child development.

An inclusive, individualised approach recognises different influences on human behaviour and acknowledges that support systems might contribute to success in the child's development and education (Florian & Black-Hawkins, 2011). Bronfenbrenner's bioecological systems theory of child development (Bronfenbrenner & Morris, 1998) reflects such considerations (see Figure 3). His model places the child at the centre of five ecological (environmental) systems (Christensen, 2016; Rosa & Tudge, 2013). The interactions between the child (bio) and its environment influences (ecological) shape its development over time (Tudge et al., 2016).

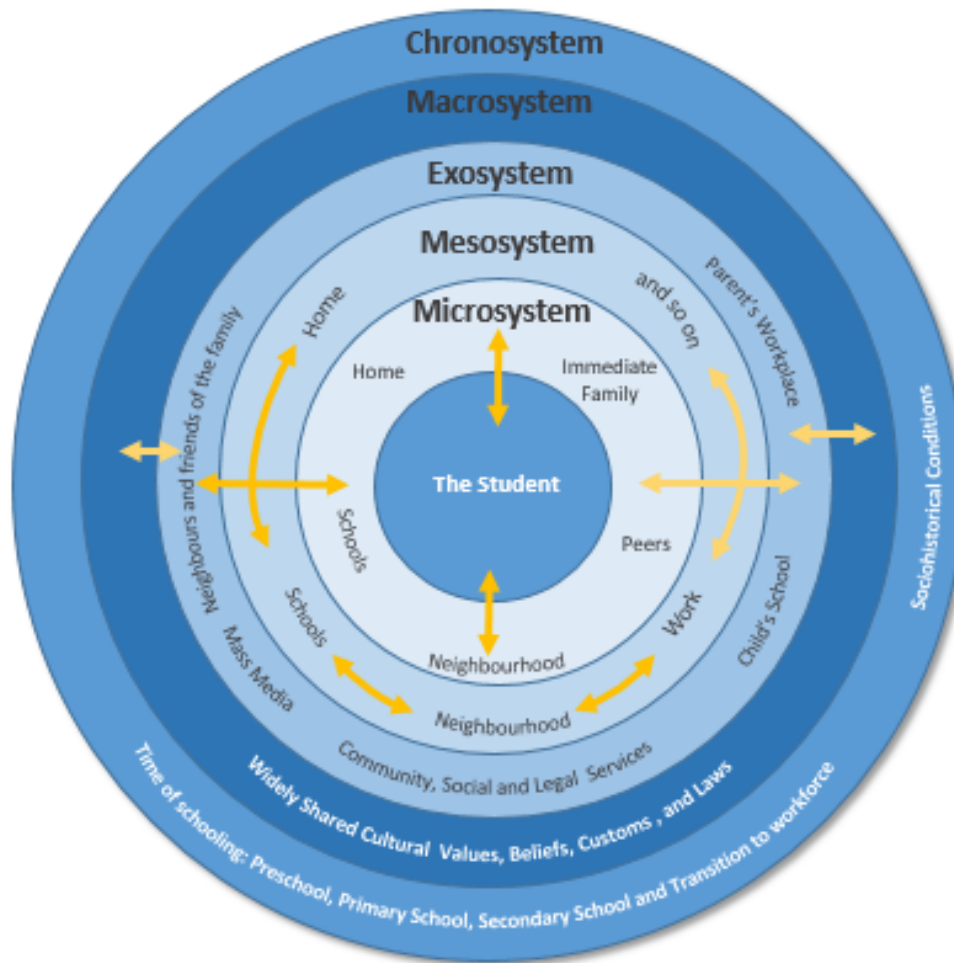


Figure 3. Bronfenbrenner's bioecological model (based on Anderson, Boyle, & Deppler, 2014, p. 28; Christensen, 2016, p.27).

Bronfenbrenner recognised that there is not always a clear division between one system and the next. These systems, viewed from the perspective of the child, are:

- 1) The microsystem – This entails the close relationships in the immediate environment where the child has most interactions and feels safe to participate, achieve and be valued;
- 2) The mesosystem – This involves the connections and relationships between the elements of the microsystem and the broader environment;
- 3) The exosystem – This consists of indirect environments and social settings that do not directly include nor play an active role for the child;

- 4) The macrosystem – This describes the broader cultural, social values and political and economic systems that impact the different contexts and systems in which the child lives;
- 5) The chronosystem – This relates to the timing of consistent events and the effect of changes over time on individual development and the broader historical context (Anderson et al., 2014; Kampenopoulou, 2016; Rosa & Tudge, 2013).

Teachers of the two New Zealand deaf education centres refer to Bronfenbrenner's bioecological systems theory in their planning and discussions with relevant people on individual students' learning and social growth (Anderson et al., 2014). Simultaneously, the teachers are mindful of group and networking contexts for their students' developmental needs (Christensen, 2016).

Individual education plan (IEP).

Individual education plans (IEP) consider the best placement and educational approaches for the particular student. An IEP identifies the level of support required for each student from people, resources, technologies, and EET (Fiedler, 2001; New Zealand Ministry of Education, 2011a, 2017b). IEPs provide students who are DHH with an educational pathway for equitable learning opportunities to facilitate a smooth transition into school and through the various stages of school education. During the post-school years, the IEP focusses on career exploration and planning, work skills, job-seeking skills, and financial management (New Zealand Ministry of Education, 2011a, 2017c).

The IEP requires collaboration and ongoing attention to ensure that it remains relevant to the student's progress, potential, passion, and creativity (Zhao, 2015). The students, teachers and families/whānau identify support staff and multi-disciplinary professionals. Team members consult and work collaboratively to achieve the student's

goals to lead a successful adult life (Hintermair et al., 2018; New Zealand Ministry of Education, 2011a). Access to specialist support may come from audiology, speech therapy, counselling, psychology, physical and occupational therapy, advisory services for deaf children, and New Zealand Sign Language tutoring programs.

The response-to-intervention model (Reutenbuch, 2008) identifies three tiers of increasing individualised involvement to describe the support and intervention required (see Figure 4). Tier one is core classroom instruction. Tier two provides focussed support through targeted small group instruction, while tier three provides the highest level of support through intensive individual intervention (Reutebuch, 2008). Such support provides a tailored wrap-around service to advance the students' language development, learning progression, and social growth at age-appropriate levels as they transition through the various stages of schooling.

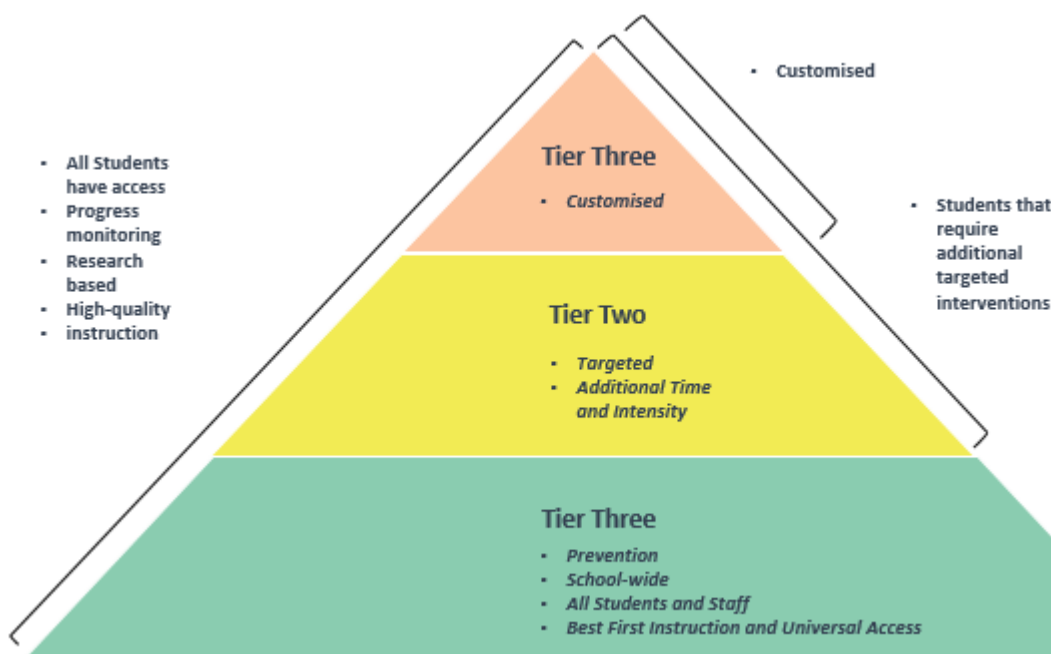


Figure 4. The response to academic and behavioural instruction intervention model (Image credit: Reutenbuch, 2008).

The New Zealand Ministry of Education defines a wrap-around service as a philosophy of care built through constructive relationships and support networks. These networks put the child and their family/whānau at the heart of education, where each person fulfils an integral and interconnected role (Cavendish & Connor, 2018; DesGeorges, 2013; Musyoka & Clark, 2015). The family/whānau's ideas and perspectives on what they consider essential for their child drive the input from the team of professionals and agencies (Ministry for Children, 2018). Ahlert and Greef (2012) concluded that family time, routines, social support, affirming communication, family hardiness, problem-solving skills, religion, a search for meaning, and acceptance of the child's hearing status were associated with family resilience. Strengthening these values helps families to meet challenges and re-establish balance and harmony within the family system.

The IEP plan uses specific, measurable, attainable, relevant, time-based (SMART) goals and backward planning to action the learning goals. Backward planning first identifies the learning goals, knowledge and skills needed and then ascertains the steps of action to achieve the goals (Childre, Sands & Pope, 2009; McTighe & Thomas, 2003; Wiggins & McTighe, 1998). SMART goals set achievable expectations and monitor specific and well-defined goals and quantifiable outputs and inputs (O'Neill, Conzemius, Commodore, & Pulsfus, 2006). These goals ensure that decisions are relevant to the IEP and that these are time-bound to the achievement dates (Bullard & Luckner, 2013; New Zealand Ministry of Education, 2011a). The review of an IEP occurs twice a year or more regularly as needed to assess targeted progress.

Māori students who are DHH.

Some New Zealand students who are DHH attend schools that offer Māori language as the medium for education. Such schools can be kura kaupapa (a primary

school which teaches Māori values through Māori language as the medium of instruction), or Māori medium (a school where all students receive Māori medium education). Another option is education, where some students have Māori medium education at school, while others have no Māori language in their learning (New Zealand Ministry of Education, 2018d). The New Zealand Ministry of Education (2011b) supports personalised learning for Māori students to ensure that they enjoy educational success.

Immersion and inclusion of Māori culture, identity and language come through various educational options (New Zealand Ministry of Education, 2011b, 2018d). New Zealand education recognises Māori culture through following the principles of partnership, participation and protection, of the Te Tiriti o Waitangi/Treaty of Waitangi (Clements, 2016; D'Cunha, 2017). In terms of EET, these principles support cultural inclusion, a sense of ownership, equitable learning outcomes and opportunities for consultation with the Māori community (New Zealand Ministry of Education, 2020). The Treaty's recognition of worldviews, equity, heritage, and biculturalism (D'Cunha, 2017; New Zealand Ministry of Education, 2013b) acknowledges similar cultural and linguistic community issues the education of students who are DHH.

Durie (1999, 2001, 2017) reintroduced the mental health model of Te Whare Whā (see Figure 5) for Māori student well-being. The education of students who are DHH in New Zealand also adopts this model. The Te Whare Whā model represents the four dimensions of well-being which should all be balanced as each is important to well-being. It recognises the impact of physical/taha tinana, spiritual/taha wairua, mental and emotional/taha hinengaro, and family relational and social / taha whānau wellness. It has a four-pronged focus incorporating physical, spiritual and family/whānau elements set in the firm foundation of land and roots/whenua (Education Review Office, 2016d; Ministry of Health, 2017).

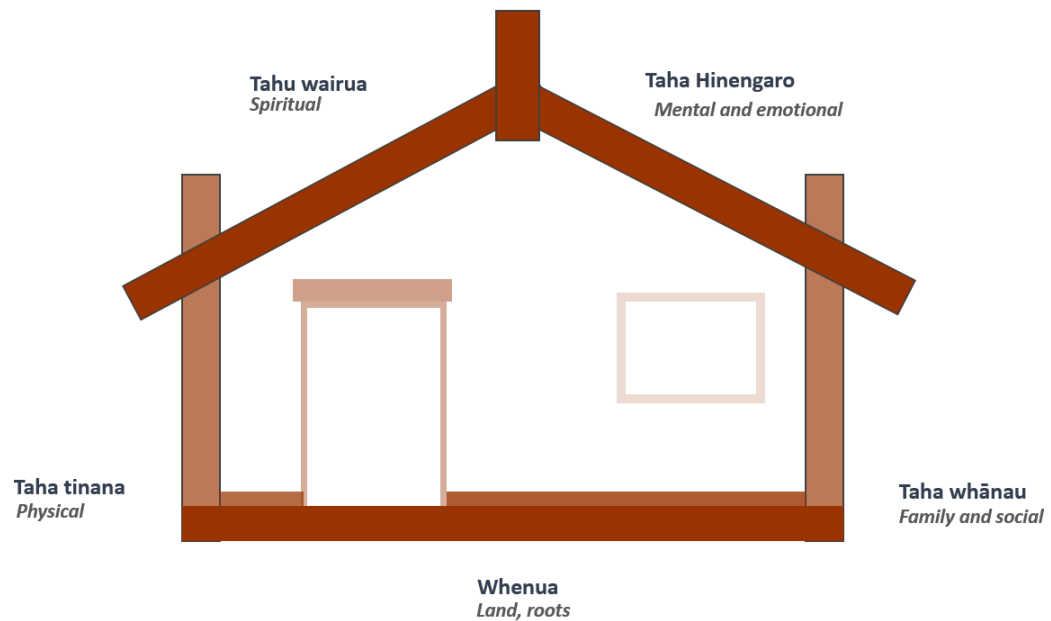


Figure 5. Te Whare Whā model (Image credit: Mental Health Foundation of New Zealand, 2020).

Further, the New Zealand Ministry of Education prepared a framework of Māori cultural concepts, known as Tātaiako (New Zealand Ministry of Education, 2011b). These concepts include manaakitanga (the responsibility and authority of the adult to care for the child's emotional, spiritual, physical and mental well-being) and whanaungatanga (making connections and relating to people in culturally appropriate ways, through past heritages, points of engagement, or other relationships). Two additional concepts are ako and mahi tahi. Ako is where the child is both teacher and learner in an integral relationship to its family/whanau, community of people/iwi and division of its community into tribes/hapu. Mahi tahi means the unity in working together in practical ways as a group towards a specific goal or implementing a task. Wānanga relates to participating with students and communities in robust dialogue to benefit Māori learners' achievement. Tangata whenuatanga affirms Māori learners as Māori by providing and affirming the contexts for learning, language, identity and culture (Education Review Office, 2016d; New Zealand Ministry of Education, 2011b).

Professional learning/Whanake ngaiotanga

Ongoing professional learning of EET practices is essential for teachers' pedagogy (Barber & King, 2016; Kreijns, Van Acker, Vermeulen, & van Buuren, 2013; Martinovic & Zhang, 2012). The Education Review Office, 2018. p. 1 states this as 'Mai i te kōpae ki te urupa, tātou ako tonu ai: From the cradle to the grave we are forever learning'. Thriving in the current and future fast-paced EET environments requires professional learning (Darling-Hammond et al., 2017; Eaton, 2015; Marlatt, 2014) to assist teachers' instructional practices (Ertmer & Ottenbreit-Leftwich, 2010).

The professional learning for teachers of students who are DHH on the rapid changes in EET focusses on gaining expertise to use technology effectively for the students' language development, learning progression and social growth (Alenezi, 2019; Hsu, 2016; Schrum & Levin, 2013; Webster-Wright, 2009). Professional learning seeks to accelerate teachers' knowledge and those working with students (Hammond, Reynolds, & Ingram, 2011; Kopcha, 2010). Therefore, it needs to continue evolving teachers' understanding of EET to ensure purposeful and productive use (Bullard & Luckner, 2013; Ward & Parr, 2010). It needs to accommodate teachers' views and provide positive experiences (Inan & Lowther, 2010a, 2010b; Mueller, Wood, Willoughby, Ross, & Specht, 2008). Investment in professional learning to increase teachers' digital fluency and their resolve to integrate EET into the curriculum form a key part of teachers' competency and proficiency over time (Barber & Mourshed, 2007, 2009; Van Eekelen, Vermunt & Boshuizen, 2006). I identified eight considerations in the literature of relevance to professional learning on EET and presented these in Table 4. In summary, it would appear that it is essential for teachers to have the time, confidence, experience, information, and skills to make sound choices regarding integrating EET in their pedagogy for their students' learning outcomes and social growth.

Table 4

Considerations Concerning the Implementation of Professional Learning

Considerations Concerning the Implementation of Professional Learning
Need for professional learning.
<p>Ongoing professional learning in EET is necessary for teachers to support, extend and enrich their own and students' learning. Teachers may be in a situation where they do not receive the support required for successful engagement and effective EET implementation in teaching. This gap, in turn, may affect the learning experiences of their students. Darling-Hammond (2017) recognised the importance of removing barriers to professional learning opportunities, which support positive outcomes for language development, learning progression and social growth.</p>
Goals of professional learning.
<p>Professional learning about EET intends to increase leaders' and teachers' confidence, motivation and autonomy in their ability to facilitate student learning with these technologies (Buabeng-Andoh, 2012; Spillane, Healey, & Parise, 2009; Ward & Parr, 2009). Adult professional learning, also known as andragogy, recognises lifelong practitioner learning as a means to continue the development of knowledge and skills (Consortium of School Networking, 2019). This professional learning, in turn, supports a student-centred pedagogy and their development of autonomy, capacity and capability (Glassner & Back, 2019; Hase & Kenyon, 2007). It further implies that students manage their learning, learning path and goals by negotiating and using inquiry, rather than teacher-led or teacher-directed structured lesson approaches, to drive their learning (Blaschke, 2012; Halupa, 2015).</p>
Time to integrate new professional learning.
<p>Adequate time is crucial for teachers to learn, practise, train and build expertise in connecting pedagogy, learning content and technology (Koehler et al., 2013). As EET advance, the time necessary to integrate and reflect on these within the school structure, socio-cultural practices, class organisation and existing pedagogical, collaborative, and networking practices becomes an increasingly urgent challenge (Wang, 2008; Morris, 2010; Murray, 2015). Time is required to implement and reflect on new strategies, resources and skills and to engage</p>

Considerations Concerning the Implementation of Professional Learning

in online synchronous (real-time), asynchronous (delayed time), or in-person professional learning activities (Comer & Lenaghan, 2013; Youngs & Cardno, 2016).

Research on professional learning about EET.

Researchers' interest in the rapidly changing field of integrating EET in education has resulted in multiple studies on this topic (Daly, Pachler, & Pelletier, 2009; Hsu et al., 2013; Kong et al., 2014). A number of these studies relate to professional learning about EET in pedagogy (Scherer et al., 2015; Voogt, Knezek, Cox, Knezek, & ten Brummelhuis, 2011). Chai and Lim (2010), Kubilinskiene et al. (2017) and Ng (2011) argued that more effort is required to support and build the teachers' capacity in terms of technological change and digital fluency. Fisher, Schumaker, Culbertson and Deshler (2010) concluded that online professional learning and its application in teaching practices could be as effective as in-person training. Hsu (2010) suggested that teachers' technology practices influence the type of technology activities and resources they assign to their students.

Strategic planning for professional learning.

Sheffield, Blackley and Moro (2018) concluded that a long-term and embedded professional learning program for EET integration is beneficial for improving teachers' confidence and preparedness in implementing the necessary changes. Strategically planned professional learning amongst colleagues can come through a cascade model or the trickle-down effect to propagate and diffuse knowledge related to EET. Leaders and expert teachers first receive professional learning. They then develop a plan to implement and pass down the agreed training through management levels and then to the teachers (Seymore & Collett, 1992). Pierson and Borthwick (2010) highlighted that professional learning in EET in teaching goes beyond obtaining feedback from participants on their level of satisfaction with the presentation. Instead, professional learning requires consideration through the lens of a theoretical foundation, organisational learning and participant research inquiry.

Challenges in implementing professional learning.

Baran and Uygun (2016) concluded that keeping abreast, advancing pedagogy with new knowledge and preparing teachers to integrate EET remains an ongoing challenge. Professional learning may be challenging to access and put to meaningful use (Daly et al., 2009; New

Considerations Concerning the Implementation of Professional Learning

Zealand Ministry of Education, 2017d). Because knowledge of EET develops over time, long-term commitment to professional learning is required (Baran & Uygun, 2016; Bullard & Luckner, 2013; Guzey & Roehrig, 2009). This professional learning includes gaining knowledge on integrating EET into the curriculum, understanding and applying educational theory, and using reliable progression assessment and evaluation practices (Jones, Cowie, & Moreland 2010; Pierson & Borthwick, 2010). Leadership can address this situation through a sustainable professional learning infrastructure for their staff (Tucker, 2019).

Professional learning for assessment.

Assessments need to provide meaningful feedback on learning intentions and accurately record what they claim to measure. They require a reliable format that different teachers can replicate on various occasions and that realistically reflects the students' actual abilities (New Zealand Ministry of Education, 2017b). Assessment practices of the benefits and limitations of integrating EET, particularly as a catalyst for learning achievement and social growth, are relationships and metrics that are difficult to calculate using a predefined numeric system (Hattie, 2012; Hattie & Brown, 2007; Terhart, 2011). Sørensen and Levinsen (2015) identified EET inclusive assessment practices to define achievement in language development, learning progression and social growth. Hattie and Brown (2007) and Jones et al. (2010) concluded that EET inclusive assessments provide additional modes of representing, recording and reviewing information on student-centred inquiry processes and projects.

Professional learning to accommodate diversity.

Professional learning assumes diversity in the classroom environments and recognises teachers' multiple and differentiated learning requirements, and requires a commitment to active, ongoing, differentiated and collaborative professional learning (Darling-Hammond et al., 2017a). Such professional learning engages teachers in active learning, strengthens personal ties and networks, fosters cross-functional and cross-centre collaboration, and focusses on the curriculum's content. Professional learning also supports collaboration, coaching based on best practice models, offers feedback, time for reflection, and making necessary changes (Donohoo & Velasco, 2016).

Leadership/Te kanohi mataara

He aha te kai a te rangatira? He kōrero, he kōrero, he korero: What is the food of the leader? It is knowledge. It is communication. (Revington, 2015)

As acknowledged in Chapter One, leadership plays a vital role in collaboration and changes that are inevitable with introducing and implementing new EET. Being in a leadership position, I am keenly interested in leaders' practices to support the meaningful integration, applications and ongoing monitoring of EET in teachers' pedagogy for students who are DHH. The research I studied collectively endorsed the argument that leadership plays a vital role in successfully integrating EET in teachers' pedagogy (Robinson, Lloyd, & Rowe, 2008; Towndrow & Vallance, 2013; Vermeulen, Van Acker, Kreijns & van Buuren, 2015). Leadership requires following established protocols to include the DHH perspective, ensuring access to New Zealand Sign Language, and accommodating regular collaborative professional learning related to the education of students who are DHH (Anderson, 2011; O'Brein, Knutze, & Appanah, 2014).

The discussion on leadership practices explored features for implementing and integrating EET in educational environments (Blau & Shamir-Inbal, 2016; New Zealand Education Council, 2018a; Senge, 1998). Further, it examined leaders' strategic planning for coordinated and equitable use of EET for all teachers and students they lead (Barrett & Breyer, 2014; Ross & Gray, 2006).

Features of leaders who integrate EET.

In this section, I discuss features of leadership for the successful and sustainable implementation of EET. Firestone and Martinez (2007), Hadjithoma-Garstka (2011), and Hargreaves and Goodson (2006) agree that these features, personal qualities and attitudes

are essential during an era of increasingly complex economic, social and demographic influences. The four leadership features I investigated included the requirement for leaders to have a foundation of values and beliefs, be visible amongst those they network with and lead (Heifetz & Linsky, 2002). Also, I examined the leadership concerning school culture and the features of distributed leadership (Ho & Ng, 2017; Leithwood & Mascall, 2008; Spillane, 2005).

Foundation.

Leaders require a foundation of values and beliefs, visibility, and a culture of practice (Australian Institute for Teaching and School Leadership, 2016, Consortium for School Networking, 2019; New Zealand Ministry of Education, 2019b). The very essence of leadership is having a clearly articulated vision (Hesburgh, 2004). The New Zealand Ministry of Education (2019b) defined four features to underpin school leadership. The first feature is that leaders lead with moral purpose and commitment to improving learning, social outcomes, professional growth, and support of other leaders and teachers (Manaakitanga). The second leadership feature is having self-belief and valuing one's self. This feature encompasses resilience, well-being, self-care and a healthy lifestyle (Pono). The third feature is that the leaders remain serious, passionate and up to date about being both a learner and a teacher (Ako). The fourth leadership feature is having empathy with groups and individuals in the school community (Awhinatanga). Having a theoretical framework in place, such as TPACK (Mishra & Koehler, 2006), appears essential for leaders as an instrument to explain the concept, purpose and role of implementing EET.

Visibility.

Leadership requires visibility and giving attention to operational, relational, strategic and systematic matters. Visibility requires emotional and social intelligence,

whereby leaders are aware and empathetic to their own and other people's feelings and use this awareness to lead themselves and others (Williams, 2008). Without a visible presence, matters such as integrating EET in pedagogy will tend to stall (Muchiri & Were, 2016; Nicholson & Kurucz, 2019). As will be seen in the results and discussion of Chapter Four and Chapter Five of this study, the research participants identified this leadership trait as visibility at a grassroots level. Visible leadership includes sharing vision and values, knowledge and understanding, and having personal qualities such as social and interpersonal skills (Doe, Ndingguri, & Phipps, 2015; Hauge, Norenes, & Vedøye, 2014). Further, leaders' practices require visibility in leading teaching and learning; developing self and others; guiding improvement, innovation and change; directing the management of the school; and engaging and working with the community (Australian Institute for Teaching and School Leadership, 2016; Clarke & Wildy, 2010; Hargreaves & Fullan, 2012).

School culture.

An essential practice of leaders who integrate EET for cognitive learning outcomes and non-cognitive social empowerment is to create, develop and demonstrate the culture of a caring community. This practice requires emotional and social intelligence in such relational values as respect, inclusion, compassion and fairness (Roffey, 2006). Leadership, therefore, needs to establish a school culture that provides direction for teachers to support the purposeful application of EET in their pedagogy (Ramoroka et al., 2017). School culture is how teachers and other staff work together and share a set of beliefs, values, and assumptions (New Zealand Ministry of Education, 2019b). A positive school culture promotes students' ability to learn and encourages leaders to talk and reflect on what leadership means (Darling-Hammond, 2015; Kazim, 2019; Wiggins & McTighe, 1998). Collaborative leadership, therefore, plays a

meaningful role in supporting, developing and inspiring staff to engage effectively and positively in EET through the complexities of change and innovation (Davies, 2010; Hallinger & Heck, 2010; Tondeur, Devos, Van Houten, van Braak, & Valcke, 2009). In a supportive school culture, leaders build a foundation of trust by developing constructive relationships with teachers (Beatty, 2007; Harris, Caldwell, & Longmuir, 2013; Noonan & Walker, 2008). There is abundant research indicating that trust contributes to collaboration and learning (Bryck & Schneider, 2003; Fink, 2014; Lankton, McKnight, & Thatcher, 2014). Hargreaves and O'Connor (2018) explain the high and low emphasis on trust in working relationships through their quadrant of collaboration (see Figure 6). The figure illustrates that no collaboration (low-trust, low-precisions) causes a culture in which there are no clear frameworks for planning, sharing decision-making and feedback on the practice. Contrived collegiality (low-trust, high-precision) results in top-down and enforced teamwork and fails to maintain motivation. Informal collaboration (high-trust, low-precision) develops solid and enduring relationships, supports professional dialogue and maintains motivation. Collaborative professionalism results when teachers have strong trust and relationships with each other. Through collaborative professionalism, teachers feel at liberty to take risks and make mistakes. This environment provides tools, structures, protocols, coaching, feedback, planning, review, practical action and continuous improvement of shared work (Hargreaves and O'Connor, 2018).

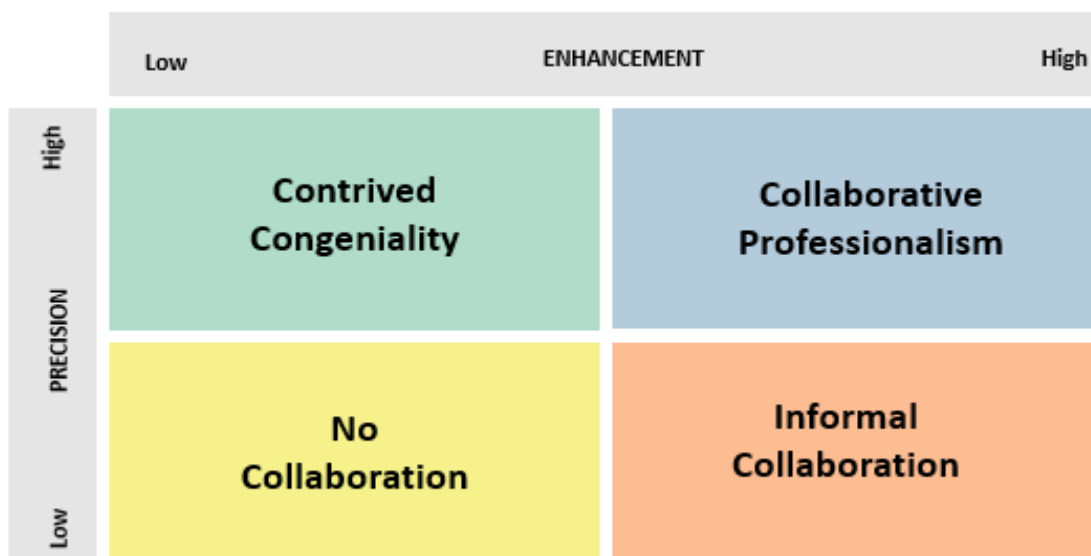


Figure 6. Quadrants of collaboration (Hargreaves & O'Connor, 2018, p. 5).

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Genuine collaborative participation and engagement when using EET require structured activities. Further, such collaboration requires positive interdependence, equal cooperation and individual accountability (Flórez-Aristizábal et al., 2019). Concerning establishing a positive school culture, Webster (2016, 2017) and Kirkman (2014) concluded that both educational goals and the curriculum need to drive technology use. Also, teachers require support to teach with current technologies.

Distributed leadership.

The principal's involvement in distributed leadership implies taking the integration of EET intentionally, locating material resources and providing psychological support. Leaders envisage a personal, equitable, integrated, holistic trajectory when they lead their teams into the future (Kowch, 2009; Woods, 2015). Distributed leadership for transferring knowledge, equity, trust and shared purpose is integral to effective digital collaboration and is an essential determinant of cooperation in a virtual environment (Harris, Jones & Baba, 2013). Further research suggested that distributed leadership

around technology in schools requires organisation for teaching and learning to remain the central focus (Davies, 2010). EET that receive support through distributed leadership have a greater chance of succeeding (Hadjithoma-Garska, 2011).

Bennis (2013), Davis, Mackey and Stuart (2015) and Tondeur, Cooper and Newhouse, (2010) concluded that distributed leadership influenced the extent of EET integration for cross-curricular connections and project-based learning. Also, Young, Berube and Perry (2008) established that EET integration by leaders might encourage the use of web-based platforms for online communities and social networks to support, extend and enrich student-centred inquiry. In summary, consistent and coordinated distributed leadership practices by the school principal and senior management are paramount in developing effective curriculum structure, course content and the degree of EET integration (Murphy & Torre, 2015; Xiong & Lim, 2015).

Leaders' strategic planning for EET.

Strategic planning is an essential factor for coherent, informed and responsive EET practices and levels of adoption and integration in schools (Kurian & Ramanathan, 2016; New Zealand Ministry of Education, 2010). Strategic planning systematically takes into account feedback, critical evaluation and understanding from past and current experiences, as well as reliable forecasts (Barber & Mourshed, 2007, 2009; Cabellon & Brown, 2017). Davies (2010) and Hadjithoma-Garska (2011) also drew attention to the importance of a well-designed strategic plan for including and implementing EET into pedagogy. Table 5 indicates five strategic planning considerations identified in the literature. These considerations include strategic guidance through change and providing teachers with the opportunities of distributed leadership. Strategic planning further considers budgetary requirements, best practices for teaching and EET for assessment.

Table 5

Leaders' Strategic Planning Considerations when Integrating EET in Education

Leaders' Strategic Planning Considerations when Integrating EET in Education
<p>Change</p> <p>Crucially, leaders understand that strategic planning, adapting, controlling and effecting rapid mandated and self-initiated change is central to dealing with the swiftly developing field of EET (Hargreaves, 2004; Holmes, Clement, & Albright, 2013). Through strategic planning, leaders provide a sense of direction, build ownership and create alignment to transform their schools to articulate the vision of integrating EET in the classroom (Afshari, Bakar, Luan, & Siraj, 2012; Bolstad, 2017; Buabeng-Andoh, 2012). Strategic leadership in schools is vital to the continued successful operation and progress of the inclusion of EET in the schools' approach to learning. Strategic leadership, therefore, follows a strong school vision and guides staff by assuring a constant improvement process. Further, strategic leadership anticipates and plans for future trends. These plans must be flexible enough to adapt to the turbulence of changes brought about for a more meaningful future (New Zealand Ministry of Education, 2020; Williams & Johnson, 2013).</p>
<p>Distributed leadership</p> <p>A strategic requirement of educational leaders is to understand teachers' needs concerning the integration of EET in their pedagogy (Consortium of School Networking, 2019). Opportunities for teachers to participate in strategic planning to make informed decisions on integrating EET in teaching could arise through distributed leadership. Being part of these strategic planning conversations may become</p>

Leaders' Strategic Planning Considerations when Integrating EET in Education

another aspect of professional learning as teachers learn what it means to select and implement technology and ask questions about cost, support, scalability and sustainability (Consortium of School Networking, 2019).

Policies and budget management

Leaders recognise that strategic planning is essential for managing EET policies and budget allocation to ensure purposeful and sustained purchases and maintenance of these technologies in teachers' daily practices. Leaders need to acknowledge that increased capital investment in EET results in significant changes to the quality of pedagogy (Barber & King, 2016; Eacott, 2007, 2011a, 2011b).

Best practices

Leadership commits to what is best for student development and learning requirements. Further, leaders who support teachers in EET usage also influence meaningful student-centred inquiry for students' social growth (Fowler, 2012; Jimerson & McGhee, 2013). When integrating EET in teaching, best practices support equity, diversity, connectedness, and coherency (Ramoroka et al., 2017; Tondeur, van Keer, Braak, & Valcke, 2008; Wallace Foundation, 2013). Leaders need to recognise the intergenerational relationships of teachers and students. These relationships are essential as the introduction of EET requires a fundamental pedagogical shift in the core activities relating to language development, learning progression and social growth (Passey, 2014; Ouellet, Romero, & Sawchuk, 2017; Leek & Rojek, 2017).

Leaders' application of EET for assessment

Assessment measures using EET provide benchmarks, information and evidence of improvement and differences. Data analysis provides results on which to base informed instructional decisions and strategic planning (Hattie, 2005; New Zealand Connected Learning Advisory,

Leaders' Strategic Planning Considerations when Integrating EET in Education

2016; Timperley, 2005). Monitoring intended and unintended outcomes provide opportunities to change direction and direct efforts towards the established educational goals (Rotherham & Willingham, 2009). Technologies support robust assessments such as benchmarks to gauge learning progress and address questions on which learning outcomes matter most for students (Roblyer & Doering, 2014; Ruggiero & Mong, 2015; Silva, 2009). Harnessing technologies as they evolve is essential to forward-looking leaders who need to continuously assess, re-examine, remix, and adapt to change in EET (Cabellon & Brown, 2017). Optimising the assessment of learning achievements and social growth of students who are DHH requires a commitment to technology-assisted education and clarity during implementation (Dede, Ketelhut, Whitehouse, Breit, & McCloskey, 2009).

In summary, leaders who use strategic planning set out to achieve challenging goals in organisational, interpersonal and decision-making roles; think and act creatively in difficult times; take swift and decisive action; manage rapid change and inspire others to perform well (Davis, 2015, Eacott, 2013; Firestone & Robinson, 2010; Imig & Fischetti, 2016). Leaders, who strategically plan, implement and assess EET to support teachers' pedagogy place their teachers in a stronger position to use these technologies (Hatlevik & Arnseth, 2012; Lefoe & Parrish, 2010; Stuart, Mills, & Remus, 2009).

Collaborative Practices/Mahi ngātahi

Collaborative learning is a teaching and learning method that implies exploring a particular topic and creating a meaningful product in the teams of pupils or students. It allows students more say in forming a friendship and interest groups. Students use the interpersonal skills of dialogue, discovery and context as a means to work things out. Collaborative learning leads to active participation in the subject of study. Collaborative activities lead to new ideas when students harness their potential and develop their past experiences and understandings (Nechita & Timofti, 2011). Collaborative practices and teamwork are essential factors in integrating EET for the teaching and learning process for the joint creation of knowledge (Buchal & Songsore, 2019; Lorenz, Endber, & Bos, 2018). McCormick (2004) identified that for the collaboration of EET, there are two considerations, namely, 'learning to collaborate' and 'collaborating to learn'. Features of collaborative discourse include socially distributed productions, repairs and negotiation of different points of view, strategies to monitor actions and interpretations, and the language required for accepting something and demonstrating ideas (McCormick, 2004). The purpose of using EET for collaborative learning is to connect and share collective intelligence concerning learning. EET enables students to share and work together to build learning content by collaboratively writing documents, constructing presentations,

creating stories and performing research. Collaborative learning requires the development of new forms and dimensions of interaction and assessment. EET, such as video conferencing and mobile phones, assist peer-to-peer collaboration. Virtual reality also provides a means for collaborative activity as learners can simultaneously engage in specific environments (White, 2008). In a collaborative environment, leadership functions as a team-based and distributed action. It relies on educational and technological expertise at multiple levels (Hauge & Norenes, 2015). However, the research of Blau, Shamir-Inbal and Hadad (2020) raised that the process and initiatives of digital collaboration were difficult and complex. Concerns are that collaborative technologies are vulnerable to security threats when used on an organisational basis, and their impact on education is still uncertain (White, 2008).

Change

The integration of EET in pedagogy is complex and disruptive, partly because of the ongoing impact of innovations and change in education (Bindu, 2016; Core Education, 2018; Fullan, 2009). Despite the benefits of integrating EET for the learning and social growth of students who are DHH, Fu (2013), Lawrence and Tar (2018) and Shepherd and Alpert (2015) identified challenges related to this rapidly evolving field. Challenges relate to attitude, confidence, competency, expectations of integrating EET in teaching and learning and maintaining these technologies' implementation in periods of change (De Smet, Valcke et al., 2016; Papanastasiou & Angeli, 2008). Further challenges arise when assimilating EET in the context of teaching students who are DHH and where there is no theoretical framework or strategic plan.

Changes in EET require teachers to engage in a paradigm shift from traditional teacher-led pedagogy to integrating future-orientated technologies for problem-based teaching and learning (Koç, 2005; Taylor & Packham, 2016; Wong, 2016). However,

many potential barriers concerning maintaining EET in pedagogy through change revolve around the individual teacher (Cabellon & Brown, 2017; Venus, Stam, & Van Knippenberg, 2015). Hence, these barriers are an essential starting point in bringing about changes to adopt and integrate new technologies (Donnelly, McGarr, & O'Reilly, 2011).

Challenges following a change may result from external factors, such as lack of access to the resources and time or the need to acquire technical skills through professional learning and support. External or internal change factors might create impediments for change (Bingimlas, 2009; Jung, 2005; Yu, 2013). Change requires a commitment to oversee the sustainable inclusion of fast, secure and robust infrastructure and resources (Hargreaves, 2004). The process of a SWOT analysis (strengths, weaknesses, opportunities and threats) might prove helpful in developing and supporting the commitment to change (Andrews, 1963; Gürel & Tat). The acquisition of new and rapidly changing technologies requires flexibility and open-mindedness to accommodate these rapid changes (Australian Council for Educational Research, 2013; Kalaš et al., 2012). Consequently, schools need to address professional learning, maintenance, economic sustainability, and EET's expandability to ensure its continued and effective use (Ra, Chin, & Lim, 2016; Valcke, De Wever, Van Keer, & Schellens, 2011). It is, therefore, necessary to evaluate EET to understand its potential influence on the learning process before adopting and integrating these into education (Aleksić & Ivanović, 2016; Higgins et al., 2012).

A theoretical framework underpins the strategic planning and practice of EET integration in pedagogy.

The research I studied frequently endorsed that EET empowers pedagogy and improves access to content knowledge (Rubio, 2009). Altuna and Lareki (2015) and

Crawford (2010) argued that there is not only a need to prepare teachers for the integration of EET but also to adopt a theoretical context for the meaningful inclusion of these technologies.

The purpose of a theoretical framework that integrates technology, pedagogy and content is to support teachers in their effective facilitation of students' learning of the curriculum content (Deng, 2018; Mishra & Koehler, 2006, 2009b). Further, a theoretical framework considers the teachers' role, classroom organisation, the teaching and learning processes, and interaction mechanisms (Sangrà & González-Sanmamed, 2010). A theoretical framework also provides a platform for reflection, direction and application to improve professional practices, especially when considering the complexities of integrating EET into teachers' pedagogy (Aitkin, 2009; Donohoo & Velasco, 2016). Theoretical frameworks, which appear to support best-teaching practices, build on the three knowledge bases of pedagogy, content and technology (Mishra & Koehler, 2006, 2009b). Various learning theories concerning the practice of integrating EET might coexist within a given school (Altuna & Lareki, 2015). In this section, I discuss five theoretical frameworks concerning the integration of EET in teaching. I next address the development of the TPACK framework and conclude with the reason for my selection of the TPACK framework as a potential model for integrating EET in the education of students who are DHH.

Theoretical frameworks.

To understand the philosophical rationale that underpins the integration of EET, I studied various theoretical frameworks. The five frameworks I discuss are the Substitution, Augmentation, Modification, Redefinition (SAMR) Model (see Figure 7); the Replace, Amplify, Transform (RAT) model (see Figure 10); and Jonassen's model of technology in a constructivist environment (see Figure 11). The two other frameworks

are the Technology Integration Model (TIM) (see Figure 12) along with the MLearning model for mobile learning (see Figure 13 and Figure 14); and the third iteration of the Technological, Pedagogical and Content Knowledge framework (TPACK) (see Figure 19). Because of its apparent suitability to the unique aspects of pedagogy for students who are DHH, I discuss the TPACK framework in depth (Koehler & Mishra, 2006, 2009, 2013; Koehler et al., 2013).

Substitution, Augmentation, Modification, Redefinition (SAMR) model.

Puentedura developed the Substitution, Augmentation, Modification, Redefinition (SAMR) model (Hamilton et al., 2016) (see Figure 7). This model describes substitution, augmentation, modification and redefinition as different methods in using technology (Hamilton et al., 2016). It supports educators in effectively incorporating technology into instruction, thinking about the best pedagogical approach and moving towards higher levels of development of thinking and skills (Consortium for School Networking, 2019).

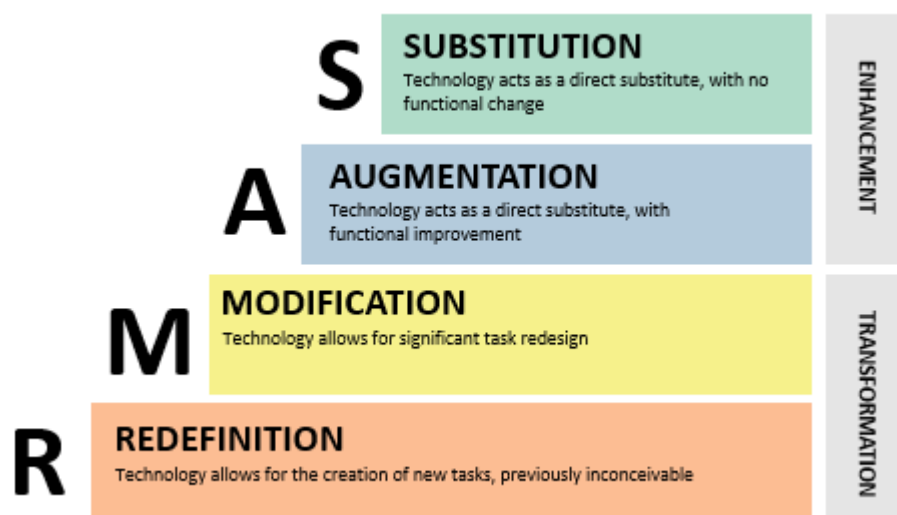


Figure 7. The Substitution, Augmentation, Modification, Redefinition (SAMR) model (based on Consortium for School Networking, 2019 p. 10; Hamilton, Rosenberg, & Akcaoglu, 2016, p. 434).

Substitution (technology used as a tool without changing or improving the task) and augmentation (the task improves with technology) use technology for enhancement. Modification (technology leads to a redesign of the task) and redefinition (technology to execute previously accomplishable tasks) are transformative for the teachers' pedagogy and the students' learning (Hamilton et al., 2016).

The progressive stages of SAMR closely relate to the stages of digital development identified by Wenmoth (2015) in Parsons (2016) and Spencer (2015) (see Figure 2) and also to that of Mandinach and Cline (1992) in Anderson (2013) (see Figure 8). Anderson (2013) illustrated the levels of increasing confidence and competence in EET. These progress from survival to mastery to making an impact with the EET and using these technologies innovatively.

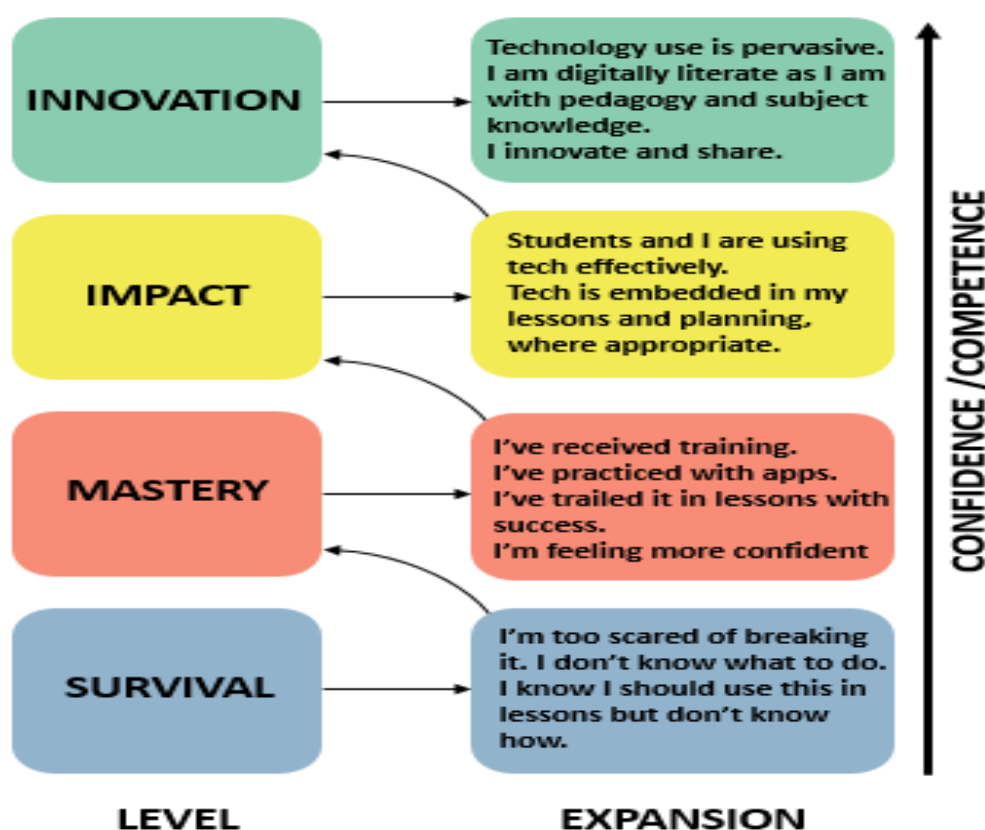


Figure 8. Teachers' confidence levels in the use of technology (based on Mandinach & Cline, 1992 in Anderson, 2013).

Further, SAMR allows for the mapping of Bloom's taxonomy to direct the educational goal of progression towards high-level thinking (see Figure 9). Such thinking develops through the levels of remembering, understanding and applying, analysing, evaluating, and creating new insights and information (Churches, 2008). Such thinking comes about by scaffolding learning and guidance from the teacher and more capable peers (Borgna, Convertino, Marschark, Morrison, & Rizzolo, 2010; Salbego, Herberle, & Balen, 2015). Teachers' regular use of emerging educational technologies appears to support students in achieving higher-order tasks (Prieto-Rodriguez, 2015).

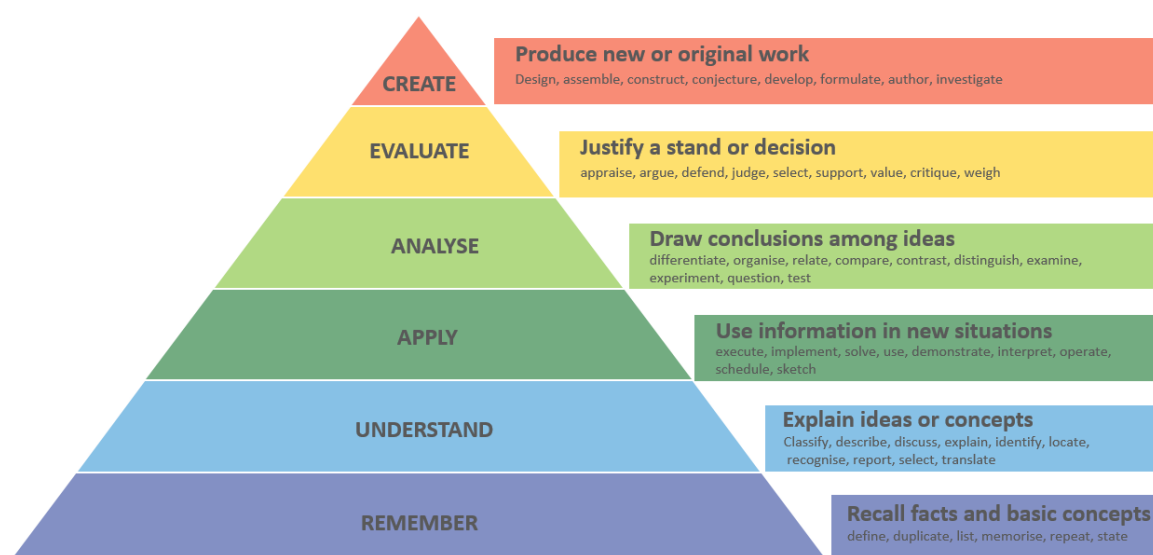


Figure 9. Bloom's taxonomy (Creative Commons Attribution License, Vanderbilt University Centre for Teaching).

Replace, Amplify, Transform (RAT) model.

Hughes, Thomas and Scharber (2006) developed the RAT model (see Figure 10). RAT views technology's functions in learning as potential resources for replacing, amplifying and transforming educational opportunities. The model holds that technology used to substitute traditional teaching merely serves as a different means to the same instructional end and does not create any discernible difference in student learning outcomes. Another use of technology is for amplification through augmentation and

modification to increase efficiency but without fundamental change. A third use is that of technology as a means for transformation. In this instance, technology allows redefining forms of instruction and learning previously considered inconceivable (Hughes et al., 2006).

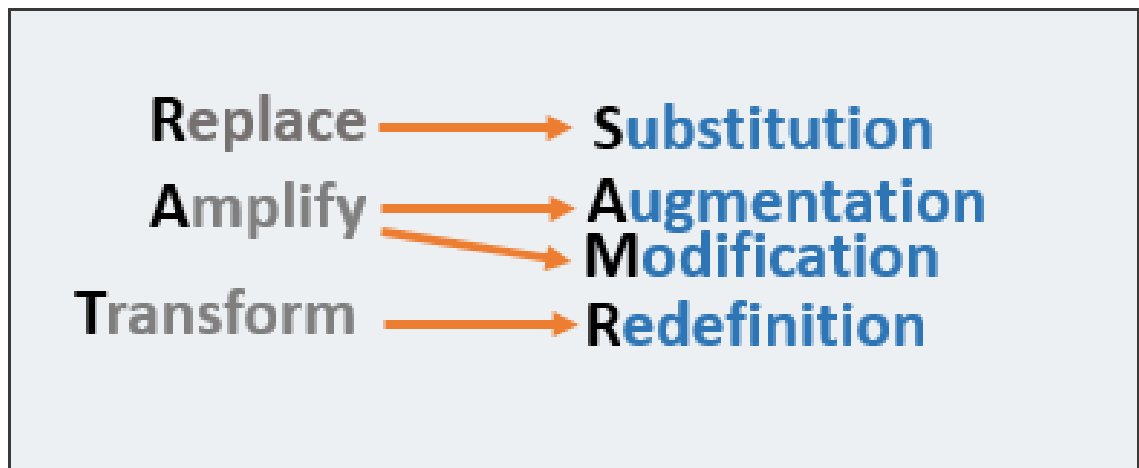


Figure 10. Replace, Amplify, Transform (RAT) and Substitution, Augmentation, Modification, Redefinition (SAMR) model (based on Kimmons, 2017, p. 5).

RAT focusses on instructional methods, students' learning processes, curriculum goals, and assessing teachers' adoption of technologies in their teaching. The RAT and SAMR model address the same issues, as substitution and replacement both deal with technology use that merely substitutes or replaces the previous use without greater efficiency. However, redefinition and transformation both deal with technology use that empowers teachers and students to learn in new ways (Hamilton et al., 2016; Hughes et al., 2006).

Constructivist model.

Constructivist theories of learning base their philosophies on the principle that the construction of learning is both individual and social. Students construct their learning best through active interactions with their environment. Such learning engages students

in intentional, complex, authentic, collaborative and reflective learning (Alexandrov & Ramirez-Velarde, 2007; Jonassen, Davidson, Collins, Campbell, & Haag, 1996).

Jonassen promoted the view that EET are most meaningful when facilitating and enabling authentic learning to construct new knowledge involving higher order thinking and problem solving skills (Ertmer & Ottenbreit-Leftwich, 2012; Giridharan, 2012).

Jonassen's view of a constructivist-learning environment provides multiple representations of reality and the complexity of the real world. His framework (see Figure 11) proposed eight characteristics that underline the constructivist learning environments (Jonassen, 1999). Regarding technologies, Jonassen concluded that new technologies, especially web-based resources, provided valuable tools for scaffolding such learning experiences (Ertmer & Ottenbreit-Leftwich, 2012). Technologies might support the intentional, collaborative construction of complex learning and the conversations and reflections surrounding these (Giridharan, 2012, Jonassen, 1999).

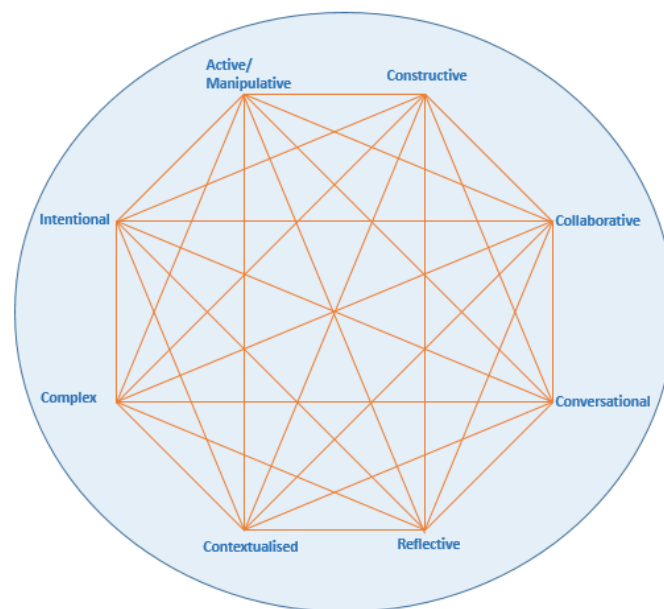


Figure 11. Eight characteristics of constructivist learning (based on Jonassen's model in Giridharan, 2012, p. 736).

Jonassen's realities of constructivist learning environments emphasise the significance of knowledge construction over knowledge reproduction. In the constructivist learning environment, learning tasks are authentic tasks in a meaningful context rather than abstract instruction out of context. Learning occurs in real-world settings or case-based learning rather than a predetermined sequence of instructions. Further, a constructivist learning environment encourages thoughtful reflection on experience. A constructivist learning environment enables context and content dependent knowledge construction to support collaborative construction of knowledge through social negotiation. It further supports adopting problem-based, project and issue-based learning (Alexandrov & Ramirez-Velarde, 2007; Jonassen, Davidson, Collins, Campbell, & Haag, 1996).

Technology acceptance, integration, acquisition and mobile learning models.

The Technology Acceptance Model (TAM) identifies that the user's acceptance of the usefulness of technology and confidence in the integration of EET are essential to using these in learning (Elmorshidy, 2012; Granić & Marangunić, 2019). The Technology Integration Model (TIM) (see Figure 12) and matrix (Florida Institute of Technology, 2018, 2019) identify the interdependent characteristics of instructional planning and integration in a meaningful learning environment.

Mobile learning (Mlearning) allows for the personal use of small hand-held portable devices such as smartphones, tablets and game consoles for an ongoing learning process. It provides the user with quick access to little bits of information (Bonfiglio-Pavisich, 2018; Shaw, Ellis, & Ziegler, 2018). Where eLearning is structured, formal and time-bound and requires larger screens with sophisticated graphics and media interactivity, MLearning is learning on-demand, just-in-time, context-aware and may provide learning opportunities in ways that have not existed previously (Grant, 2019;

Terras & Ramsay, 2012). Further, MLearning emphasises the ubiquitous and strategic integration of learning through technologies by converging device, learner and social aspect (Al-Hunaiyyan, Al-Sharhan & Alhajri, 2017; Kooles, 2009) (see Figure 13 and Figure 14).

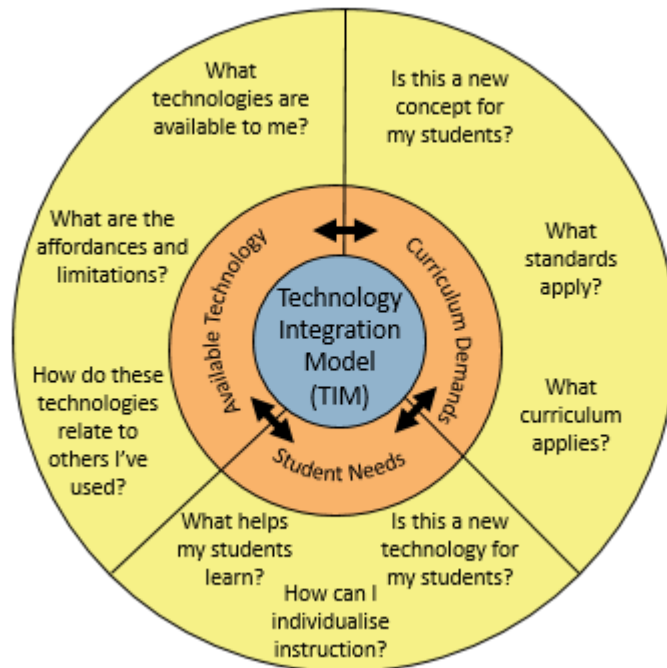


Figure 12. The technology integration model (TIM) for instructional planning (based on Florida Centre for Instructional Technology, 2018).

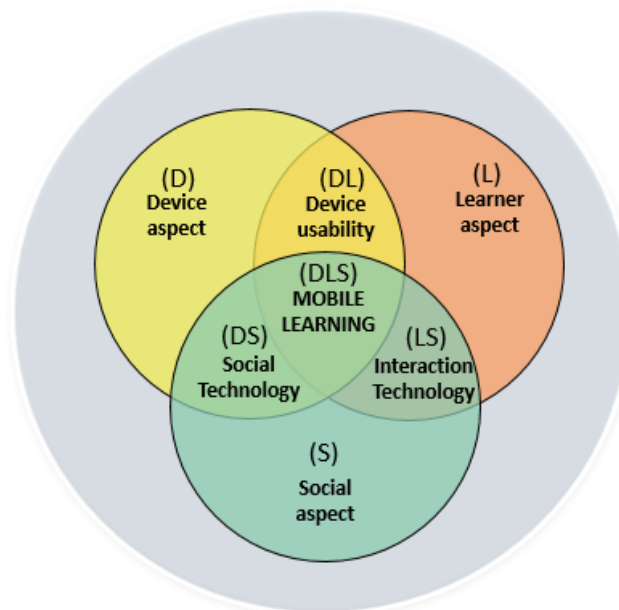


Figure 13. Aspects of M-Learning (mobile learning) (based on Kooles, 2009, p.27).

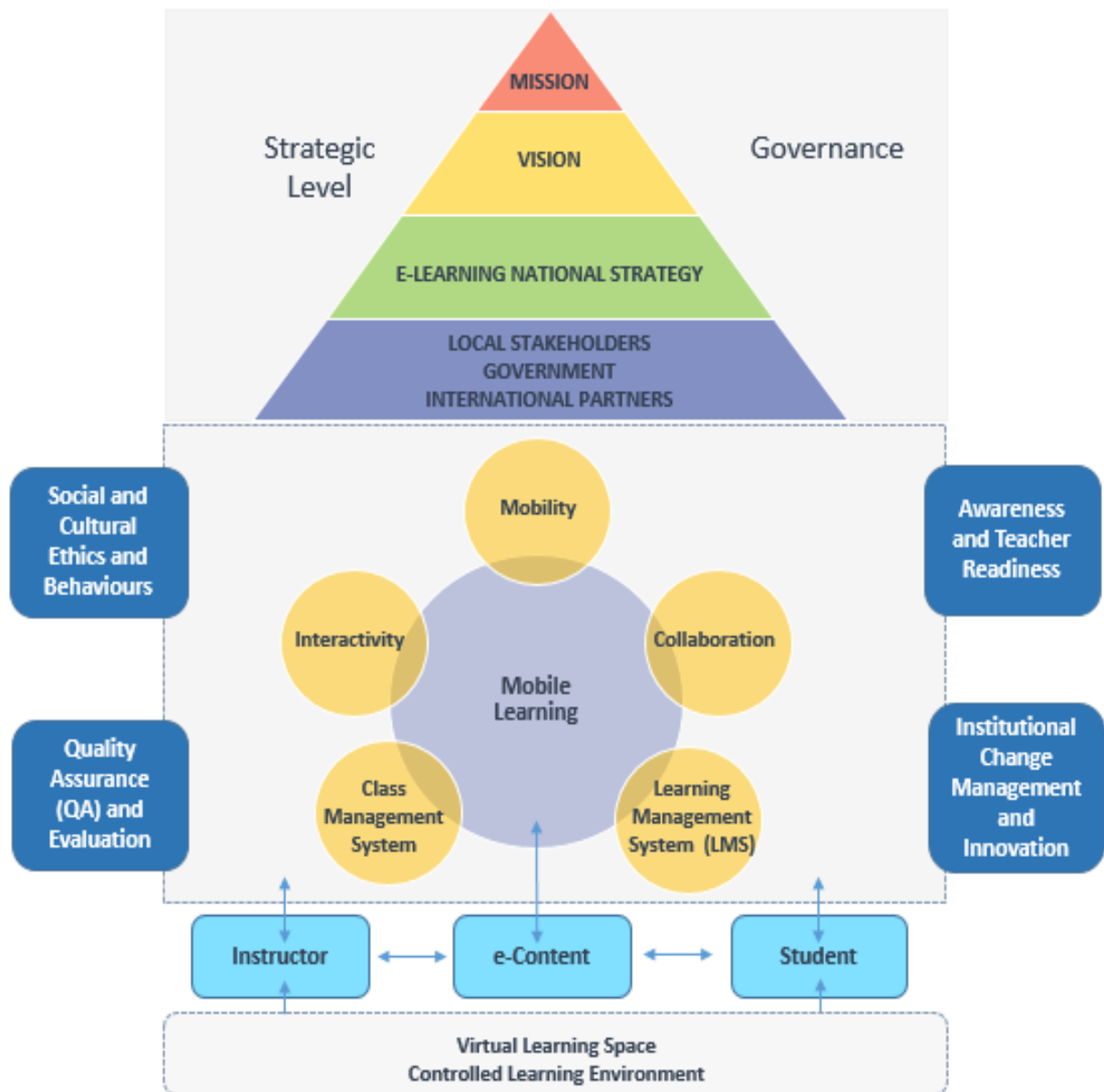


Figure 14. The New M-Learning Model (based on Al-Hunaiyyan, Al-Sharhan & Alhajri, 2017, p. 46. With permission Creative Commons Licence).

Technological, Pedagogical and Content Knowledge (TPACK) framework.

The third iteration of the TPACK framework (see Figure 19) and the RAT/SAMR model (see Figure 10) are comparable but different in scope (Hamilton et al., 2016; Koehler & Mishra, 2009; Mishra & Koehler, 2006). While RAT and SAMR provide a gauge of the degree of technology use, the TPACK framework provides an

understanding of how to integrate technology into teaching (Hilton, 2015). The following section investigates the development and application of the TPACK framework in greater depth (Koehler & Mishra, 2013; Koehler et al., 2013).

Development of the TPACK framework.

To develop the TPACK framework, Koehler and Mishra (2005, 2009) built on Lee Shulman's construct of pedagogical and content knowledge (Shulman, 1986, 1987; Shulman & Shulman, 2004) (see Figure 15).

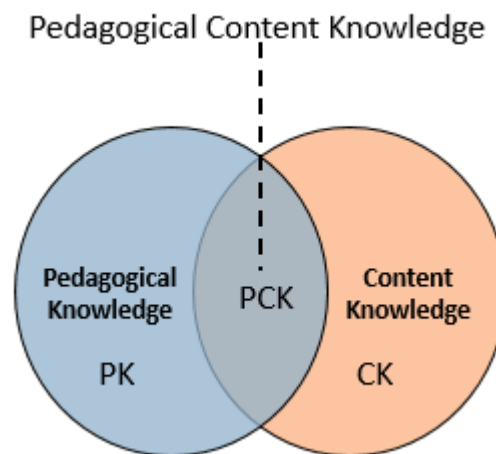


Figure 15. Shulman's pedagogical content knowledge framework (based on Mishra & Koehler, 2006, p.1022).

Shulman stated that the content of educational information and experiences come through teaching and learning pedagogy (1986, 1987). He argued that the teachers' content knowledge of subject matter requires integration with pedagogy to comprise pedagogical content knowledge (Harris, Phillips, Koehler, & Rosenberg, 2017). The domains of content and pedagogical knowledge include cycles of activity such as understanding the purpose of subject matter; transformation through preparation, adaption to students' learning needs; and instructional activities associated with teaching. Other cycles consist of evaluation to check students' understanding and adjustment of teaching performance. Further cycles include

reflection, reviewing, reconstructing, and analysing the evidence of teacher and student performance and teaching experiences (Shulman, 1986, 1987; Shulman & Shulman, 2004).

First iteration of the TPACK framework.

In their first iteration of the TPACK framework, Koehler and Mishra (2005, 2009) proposed a third knowledge domain, namely technology (see Figure 16). They argued that technology is an essential and inseparable component of the teachers' overall knowledge. Integrating technological knowledge into current learning contexts allows the transformation of subject content in ways that make knowledge accessible to individual teachers and students in their unique settings (Koehler & Mishra, 2009). Koehler et al. (2013) also argue that the effective use of EET in teaching requires a dynamic interchange among the TPACK domains. By adopting this model, teachers have the flexibility to navigate the TPACK space, become innovators of instructional practices and develop the capability to build learning environments for the current digital society (Based on Koehler & Mishra, 2005).

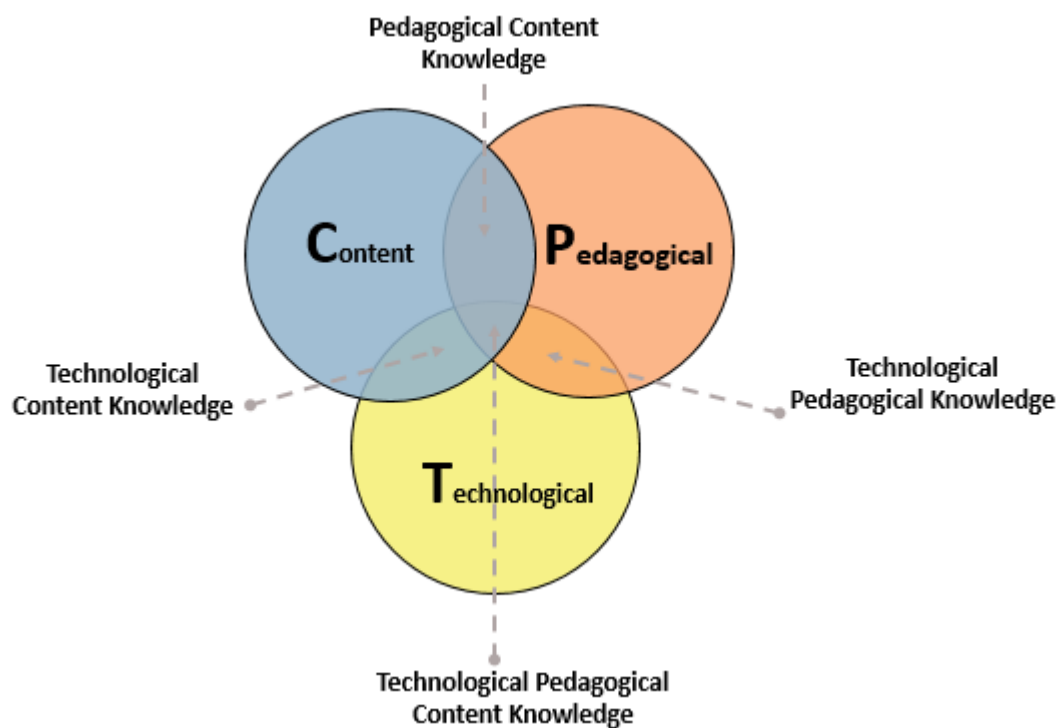


Figure 16. The first iteration of the TPACK framework (based on Mishra & Koehler, 2006. p. 1025).

The three domains of knowledge required to develop good teaching practices based on the TPACK framework are first content knowledge (CK). This knowledge relates to the ‘what’ of learning, namely the subject knowledge conveyed for learning. The content of subjects focusses on the knowledge that the teacher and students have of the subject.

The second domain is pedagogical knowledge (PK). This knowledge refers to the ‘how’ of student-centred inquiry, what teaching approaches and strategies fit the content of learning, and how to arrange these elements for better teaching and understanding. Pedagogical knowledge implies knowing the best practices, teaching strategies, methods, goals, values for individual students’ instruction and learning.

The third domain is Technology Knowledge (TK). This knowledge denotes the appropriate use of available technology tools and practices to enhance or transform learning content (Cox & Graham, 2009; Mishra & Koehler, 2006, 2008). In this model, technologies range from the everyday application of traditional resources such as books to current EET such as whiteboards, video and photos, digital hardware, software and apps, the use of appropriate cloud-based software, and networking systems as a media for knowledge (Chai et al., 2013; Mishra & Koehler, 2006; Schmidt et al., 2009).

Central to the framework is Technological, Pedagogical, and Content Knowledge (TPACK) (Koehler & Mishra, 2009; Mishra & Koehler, 2006). Competencies and fluency in the intersection of the three domains of knowledge (Content, Pedagogical and Technological), and the three subdomains (Technology Content Knowledge (TCK), Pedagogical Content Knowledge (PCK) and Technology Pedagogical Knowledge (TPK)) account for wide variations and flexibility in the integration of EET in teaching the curriculum (Archambault & Barnett, 2010; Mishra & Koehler, 2008; Koehler et al. 2013).

Second iteration of the TPACK framework.

In a subsequent development of the TPACK framework, Koehler and Mishra (2009) included a dashed circle around the domains and subdomains of the Venn diagram (seen Figure 17 and previously depicted in Figure 1). This circle signifies recognition of the various contexts that influence the implementation of technology. TPACK does not exist in a vacuum but instead integrates into specific learning and teaching contexts (Mishra & Koehler, 2008). Mishra and Koehler (2006) identified that digital technologies in classrooms are context-bound in subject matter, grade level, student backgrounds and the available technologies. The critical point is that because context varies, TPACK implementation presents differently in primary, intermediate, high school or in special education settings, including education for DHH.

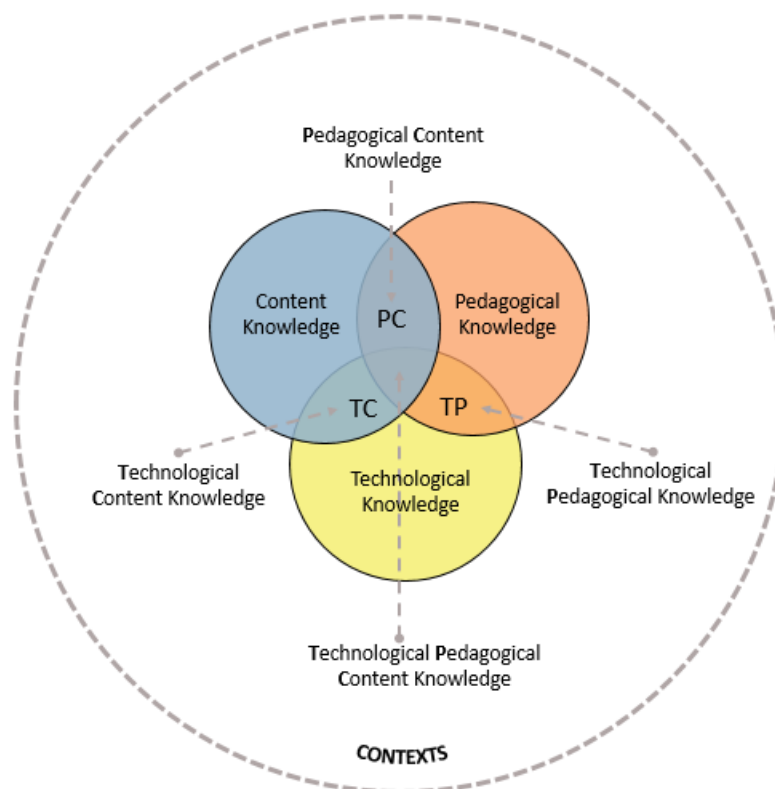


Figure 17. The second iteration of the TPACK framework (as illustrated in Koehler & Mishra, 2009, p. 63 and reproduced by permission of the publisher, © 2012 by tpack.org).

Various researchers such as Koh, Chai and Tay (2014) and Rosenberg and Koehler (2015) noted the significance of these teaching contexts and represented these through different figures. An example is the research of Tunjera, Condry, Chigona and Tiba (2016). They argue that integrating the six contexts on the dotted circle of the TPACK framework leads to deeper expertise in subjects taught (see Figure 18).

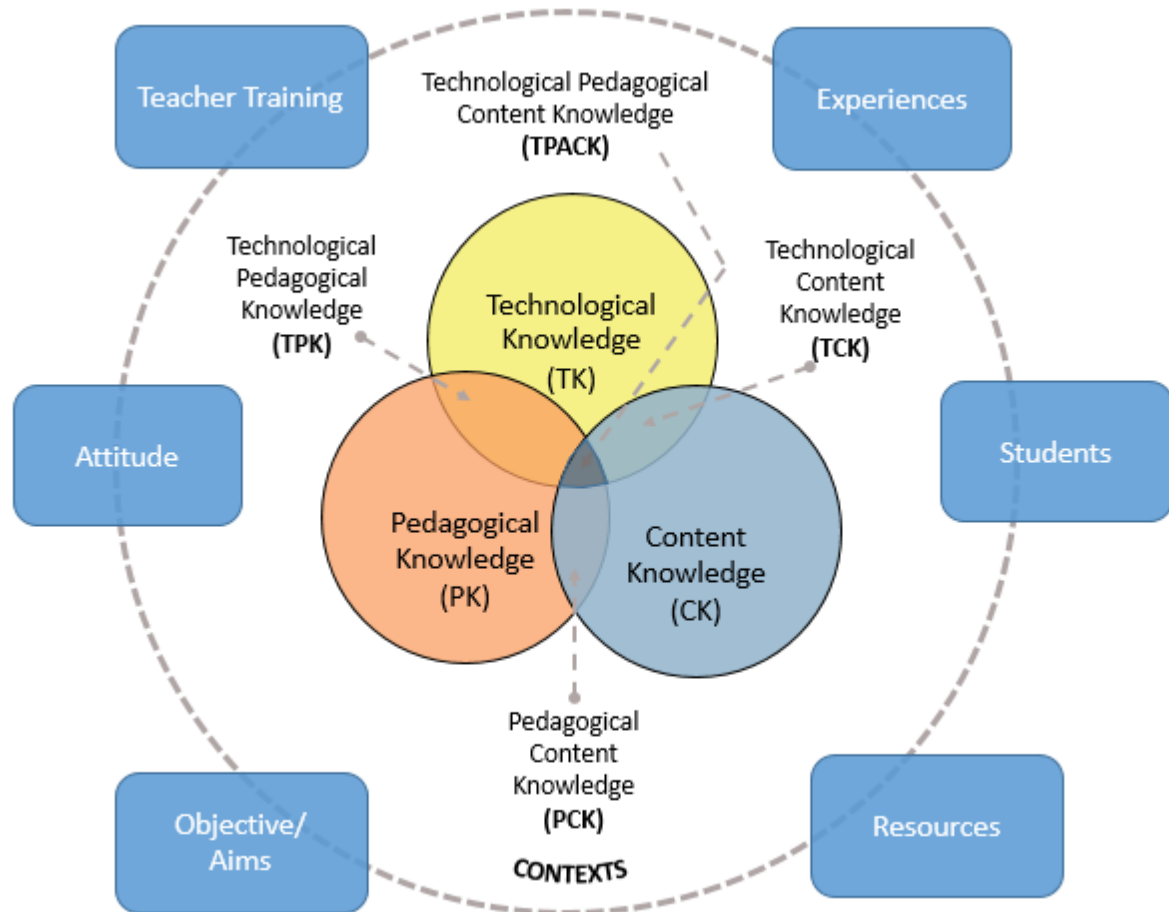


Figure 18. Six identified contexts in the implementation of TPACK (based on Tunjera, Condry, Chigona and Tiba, 2016, p. 3093).

Third iteration of the TPACK framework.

Mishra (2018) argued that the outer circle, representing context, is another essential knowledge domain that teachers require to integrate EET effectively in teaching (see Figure 19). He named this knowledge domain ConteXtual Knowledge and uses the acronym XK to distinguish it from Content Knowledge (CK). He further explains that X

denotes variables and that contextual knowledge can be highly variable. XK gives teachers knowledge of the contexts within which their organisation functions to bring about sustainable change.

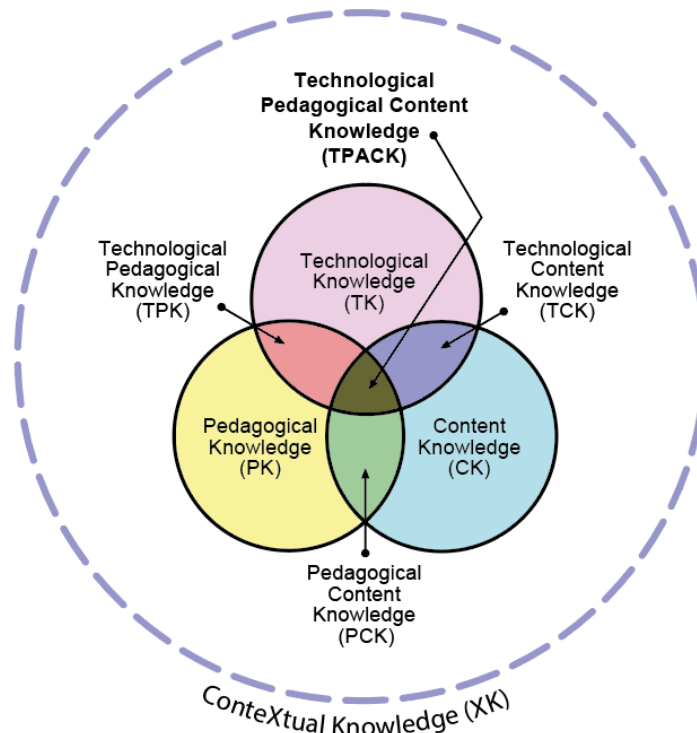


Figure 19. The third iteration of the TPACK framework. © Punya Mishra, 2018.

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Importantly, Mishra and Koehler (2006) argued that knowledge in digital technologies use does not automatically guarantee good teaching, as there are multiple challenges involved when teaching and learning with digital technologies. Further, TPACK requires careful consideration for the unique contexts of the education of students who are DHH. The context of access to language acquisition and knowledge is of particular importance in these students' education. Based on the literature review, Chapter Six recommends TPACK contexts specific to the education of students who are DHH. In summary, the TPACK framework (Koehler & Mishra, 2013; Mishra et al., 2013) brings together the content, pedagogy and technology required by teachers for

technology integration. It offers both educators and policymakers the possibility to analyse and reflect on technology integrated planning (Koehler & Mishra, 2009; Mishra & Koehler, 2006).

Selection of the TPACK framework

I investigated various models and frameworks that include EET in pedagogy and then specifically studied the TPACK framework (Koehler & Mishra, 2009). I reflected on its six contexts in terms of their relevance for thinking about, understanding and applying technology purposefully to the context of teaching students who are DHH. I based my choice of the TPACK framework on how it reflects the perspective that technological knowledge is not a separate knowledge set (Koehler & Mishra, 2009; Mishra & Koehler, 2006). Instead, it identifies that the EET integration in pedagogy supports, enriches and extends student learning (Consortium for School Networking, 2019).

Messina and Tabone (2012) discussed the TPACK framework as being “particularly appropriate for stimulating teachers’ reflections on what integrating technology in teaching means” (p.1016). The domains of the TPACK framework can also translate into the New Zealand Curriculum parameters and align to the values articulated by the Board of Trustees (Board of Trustees, 2019; Koehler, Mishra, & Cane 2013; New Zealand Ministry of Education, 2007b). Further, the overlapping domains of the TPACK framework (Koehler & Mishra, 2013; Koehler et al., 2013) appear to accommodate educational contexts for students who are DHH.

Kopcha, Ottenbreit-Leftwich, Jung and Baser (2014) and Olofson, Swallow and Neuman (2016) are of the view that the TPACK framework developed by Koehler and Mishra (2009) undoubtedly provides a useful lens and adds value to teacher conversations about technology integration in a theoretical and practical sense. TPACK

provides a framework that enables teachers to understand how to learn, think and consider their approaches to EET and their relationship to it as well as supporting their integration and adoption of these technologies in their pedagogy (Baran, Chuang, & Thompson, 2011; Koehler & Mishra, 2005; Mishra & Koehler, 2006). Recent research suggests investigating fields beyond those in the TPACK framework (Bibi & Khan, 2017). Other studies urged for research into the long-term effectiveness of the TPACK theoretical framework (Graham, 2011).

Summary

This literature review highlighted salient matters concerning teachers' integration of EET in their pedagogy for the education of students who are DHH. The literature provided a broad overview of current research trends in EET and teachers' motives for integrating these technologies in their pedagogy. From this overview, I could identify some challenges of integrating EET in pedagogy.

Concurrently, I studied literature that investigated contexts for integrating EET in the education for students who are DHH and the teaching capacities required. The available research is limited when compared to research on the integration of EET by teachers in mainstream teaching. My literature exploration revealed two further gaps in the knowledge base around teachers' integration of EET for the education of students who are DHH. The first gap concerns the lack of research on these teachers' professional learning for integrating EET in their teaching. The second gap involves leadership practices in the education of students who are DHH to support these teachers in their purposeful integration of EET into their pedagogy. There is little research on how these support teachers in their practices of integrating EET in their teaching.

The literature review introduced situations that prepared me for the discussion and conclusion chapters. One situation focussed on the potential of EET to enhance

educational learning achievement and social outcomes for all students. Another situation required an exploration of equity and the inclusion of access to EET to offer potential benefits in the education of students who are DHH. Not addressing equity and inclusion might mean that these students are at risk of falling behind their mainstream peers. Two other situations concerned the ongoing professional learning and time required for the successful implementation of EET in teaching and recognising that school leadership plays a crucial role in supporting teachers' effective EET integration.

The TPACK framework of Koehler and Mishra (2005) provided the theoretical framework on which to base my research. I chose the TPACK framework because it supports the view that technological knowledge helps teachers use, combine and integrate technology with their pedagogy, rather than keeping technology as a separate knowledge set (Koehler & Mishra, 2009; Mishra & Koehler, 2006).

The literature investigated for this chapter revealed a gap in the knowledge base of the specific context relating to the use of EET in the pedagogy of teachers of students who are DHH. My studies, therefore, aimed to investigate and add to existing research on considerations and leadership practices for the integration of EET in the education of students who are DHH. Further, the literature review provided the foundation for explaining my methodology and study design as set out in the next chapter. Chapter Three also provides details of the research participants and the setting.

Chapter Three: Methodology and Methods

Whether we are looking at the world through quantitative or qualitative eyes, we reconceive the world in terms of the concepts and relationships of our experience. (Stake, 2010. p. 30)

The methodology in this chapter concerns gathering data on the integration of EET by teachers of students who are DHH. I hope that the data gathering and analysis results will support the gap in the literature on this field and contribute to the education of students who are DHH. This chapter details the methodology, design, and data collection methods for my explanatory sequential mixed methods research. The rationale for using mixed methods was that together both the qualitative and the quantitative findings provided a better understanding of the research problem and the participants' viewpoints and experiences than either method could do by itself (Creswell & Plano Clark, 2018). This methodology was suited for developing mixed methods questions to collect, analyse, mix, interpret, and report quantitative and qualitative data in a single study. I used the data to investigate the same underlying phenomenon, namely the integration of EET by teachers of students who are DHH.

Further, the methodology supported the sequencing and visualisation of my data (Leech & Onwuegbuzie, 2008). The data from the application of two research instruments prepared me for a thematic analysis of the data to identify themes and meaning across the dataset and provide answers to the four research questions (Creswell, 2014). The results of the data analysis, in turn, informed my findings, discussion and conclusions, as seen in Chapters Four, Five and Six. Further, I also address the assumptions, scope and delimitations of this research in this chapter.

Methodology

The methodology provided a systematic approach and sequence to construct an explanatory sequential mixed methods research design (Creswell & Plano Clark, 2018; Schoonenboom & Johnson, 2017). The methodology determined the method (Chapter Three), which was consecutively followed by a report of results (Chapter Four) and then the discussion of these results (Chapter Five). Further, the methodology addressed the approach to solving the research problem's inquiry (Creswell, 2014; Cohen et al., 2004). My methodology developed from an inductive, explanatory sequential research method (Elliott & Timulak, 2005; R  th & Kasper, 2017). I identified the mixed method methodology as best suited to gain comprehensive information and insights into the research participants' understandings of EET (Morgan, Reichert & Harrison, 2016; Ongwuegbuzie & Leech, 2006; Shorten & Smith, 2017). This method utilised the purposeful mixing, integrating, analysing, interpretation and evidence of qualitative (open-ended questions) and quantitative (closed-ended questions) data collections according to the research questions.

The explanatory sequential mixed methods design assisted the expansion and detail of my research. It further supported overcoming the limitations and biases of individual methods (Cameron, 2011; Gioia, Corley, & Hamilton, 2012; Yin, 2018). Mixed methods enabled me to add to the knowledge and evidence-based empirical data of research literature (Bengtsson, 2016; Cameron, 2009). It also allowed me to examine data and literature, seek answers to my research questions, bring together the philosophical foundation and the conceptual theory of my research and build on learning from previous research (Brown, 2008; Neuman, 2016; Nichols, 2003).

Mixed methods facilitated the triangulation process, which identified convergences and interconnection of results to compare and contrast across the literature

and data sets (Creswell & Plano Clark, 2018; Scott, 2007). Triangulation allowed me to utilise more than one method of data collection on the same topic to assure the validity of the research (Carter, Bryant-Lukosius, DiCenso, Blythe, & Neville, 2014; Onwuegbuzie & Leech, 2006). I could, therefore, combine the collecting, analysing, and interpreting of both quantitative and qualitative data for an in-depth investigation of the phenomena underlying participants' use of EET in their pedagogy and examine similarities, contradictions and new perspectives (Cameron, 2009; Venkatesh, Brown, & Bala, 2013; Yilmas, 2013). The choice of my methodology thus offered potential opportunities to expand and add breadth and scope to the research and learn something new about the participants regarding their application, attitudes and experiences of EET in their pedagogy (Collins, Onwuegbuzie, & Sutton, 2006; Richards, 2005).

Design

I chose an explanatory sequential mixed methods design to explain my rationale and answer my research questions, which investigate the phenomenology of integrating EET by teachers of students who are DHH (Cohen et al., 2004). Further, this design allowed for a logical integration of the various research components and ensured that I addressed the research questions effectively (Cameron, 2009, 2011). In this design, the two data collections (first quantitative data and then qualitative data) for this single research provided material for separate quantitative and qualitative data analysis. These two data sources were systematically integrated (mixed) and merged. This merging allowed for comparisons and discovery of relationships that provide insight into interpretation (Creswell & Plano Clarke, 2018).

The design further defined the setting, research questions, setting, and the purposive sample size of the voluntary participants for both the ethics approved online survey and in-person interview research instruments (Cohen et al., 2004; Creswell &

Plano Clark, 2018). The inclusion of tables and figures provide visual displays to categorise, display demographic information, present conclusions and conceptual frameworks and explain the data (Verdinelli & Scagnoli, 2013). I intended the design to be repeatable and generalisable so that other researchers might implement their study in a similar manner (Cohen et al., 2004).

Rationale for the mixed methods design.

The rationale for an explanatory sequential mixed methods research was to address the problem statement and the four research questions raised in Chapter One. The justification was to identify such pedagogies, leadership practices and theoretical framework elements and contexts that might support student language development, learning progression and social growth by investigating the integration of EET by teachers of students who are DHH in New Zealand. The rationale endorsed the need for research, which contributes towards addressing the scarcity of literature in this field.

I selected an explanatory sequential mixed methods design to understand the participants' thoughts and experiences and the concepts explained in the literature (Johnson, Onwuegbuzie, & Turner, 2007). The design involved data collection from mid-November 2018 to early January 2019, followed by statistical analysis. Further, the design supported the TPACK framework investigation (Mishra & Koehler, 2006), described in Chapter 2, for implementing EET in pedagogy. My research design allowed for the sequential analysis of the research findings and discussion of these in Chapters Four and Five (Creswell, 2014; Jalil, 2013; Richards, 2005).

Research questions.

The quantitative and qualitative nature of my research questions used in the explanatory sequential mixed methods design encouraged my investigation of a broad

picture before defining the findings and insights on each question's specific enquiries (Creswell & Tashakkori, 2007b). Consistently coming back to the research questions provided me with a means to maintain clarity and keep focus throughout the research instruments' implementation. The research questions further provided me with direction in exploring and analysing the data and arriving at conclusions from the literature findings and the participants' perspectives (Agee, 2009). The four research questions are:

Question One: How are teachers of students who are deaf or hard of hearing in New Zealand integrating emerging educational technologies into their teaching?

Question Two: What are the opportunities and challenges faced by teachers of students who are deaf or hard of hearing, and the support required by them to integrate EET into their pedagogy?

Question Three: What features of emerging educational technologies do teachers of students who are deaf or hard of hearing perceive as positive and negative to student-centred inquiry outcomes and social growth?

Question Four: What leadership practices do teachers of students who are deaf or hard of hearing perceive as enabling or hindering the equitable implementation of emerging educational technologies for student-centred inquiry?

Research setting.

My research occurred in the national context of education provided by the two deaf education centres in New Zealand for students who are DHH. The centres are Kelston Deaf Education Centre in Auckland in the North Island and van Asch Deaf Education Centre in Christchurch in the South Island. Geographically, this education

extends across the width and length of New Zealand from Cape Reinga in the far north to Invercargill in the deep south. New Zealand covers a distance of approximately 1,600 kilometres and a width of 450 kilometres at its widest point (Alexander et al., 2018).

The 2018 June meeting papers of the Board of Trustees recorded that the two centres collectively employ approximately 226 teachers (Combined Board of Trustees, 2018). These teachers' pedagogy aligns with the New Zealand Curriculum and its expected educational outcomes (Combined Board of Trustees, 2019; New Zealand Ministry of Education, 2007b). Further, the education of students who are DHH aligns with the national education goals, the National Certificate of Educational Achievement (NCEA) and the levels of the New Zealand Curriculum (New Zealand Ministry of Education, 2007b). Collectively, these teachers teach over 2,000 students ranging from pre-school (early childhood education) to Year 13 (New Zealand Ministry of Education, 2007b, 2017g). The two deaf education centres also provide post-school education for students up to 21 years of age to prepare for tertiary studies, vocational training or the workforce (Combined Board of Trustees, 2018).

The settings where teachers engage with these students are either in classrooms, known as provisions, attached to a mainstream school or at mainstream schools where students who are DHH attend their local school. In the latter case, hubs provide these itinerating teachers with a space to perform their administrative work and a base to meet up with colleagues (Combined Board of Trustees, 2018a). In New Zealand, these peripatetic teachers are named resource teachers.

Multiple students receive support through the service known as Assessment Involving Specialist Teacher (ASSIST). This service focusses on assisting students' audition through the appropriate use of the audiological equipment assigned to them and

providing auditory-verbal therapy. Both deaf education centres employ staff to provide this service.

Table 6 shows the distribution of students across the two deaf education centres. The provisions of both deaf education centres have approximately 123 enrolled students. About 813 students receive educational support from itinerant teachers who visit them at their local school. ASSIST provides services for approximately 1,646 students.

Table 6

Distribution of Students Receiving Education Services from the Two Deaf Education Centres in New Zealand (2018)

Service Provider	Students enrolled in the provisions	Students enrolled in the resource teacher of the deaf service	Students receiving service through ASSIST
Kelston Deaf Education Centre	89	441	1,055
Van Asch Deaf Education Centre	34	372	591
TOTAL	123	813	1,646

Research participants.

The teaching population that I focussed on were New Zealand teachers of students who are DHH. The Board of Trustees of the two deaf education centres employs teachers to teach at the provisions attached to mainstream schools or mainstream schools where students attend their local school (Combined Board of Trustees, 2019). The participants in this study were certified teachers and met the teachers' criteria in the education of DHH students (New Zealand Teaching Council, 2019a, 2019b). As teachers live in different locations, some faced geographical barriers when providing services over vast distances. A consequence of such geographic restriction is its impact on the successful and uninterrupted EET delivery for the students' language development, learning progression and social growth.

I sought endorsement from the Board of Trustees, the New Zealand Ministry of Education, and the University of Newcastle's Ethics Committee to recruit and engage with these teachers as voluntary participants for this research. I requested permission from these two entities to distribute my first research instrument to the teachers working at the two centres at that time. This research instrument consisted of an online survey with 17 questions and an invitation to voluntarily participate in an hour-long in-person interview comprising of nine questions relating to the teachers' views and experiences of EET. I thus intended to create an opportunity to gain the most significant quantity of responses for a comprehensive representation of data. I identified all teachers as possible participants, and the principals permitted me to reach out to them for research purposes.

After receiving the endorsement, the next phase involved the distribution of the survey to each teacher. With the principal's permission, I approached a selected administrative staff member to distribute the online survey with the invitation to participate in an in-person interview by e-mail and also to send three follow-up reminders. The intent of utilising an administrative staff member to distribute the e-mails ensured a measure of separation and direct contact between the potential participants and myself as the researcher.

The teachers, a cohort of 163 potential participants, received the e-mail with an invitation to respond to a survey hosted on the Survey Monkey platform. There was no separate signed consent form to complete before participating in the online survey. Instead, the survey explained that the teachers' anonymous participation indicated their informed consent to partake voluntarily in the online researcher-designed survey. Further, along with the invitation to participate in the study, participants received information on the procedures to ensure their safe involvement. However, those participants who accepted the invitation to participate in the in-person interview were required to sign a

consent form, agreeing to their voluntary participation, before the interview took place (Cameron, 2011). I informed and updated the principals of both deaf education centres on my contact with the research participants.

The first step in selecting and recruiting participants to participate in an in-person interview, to define how teachers of students who are DHH integrate EET in their pedagogy, was to determine the size of the population and include only those teachers who engage with EET in their teaching. Creswell (2014), Fusch and Ness (2015), and Merriam and Tisdell (2016) indicated that while the interview sample size might vary, the guiding principle should be data saturation. Saturation occurs when the samples and analysis reach completeness and are sufficient to explain the claims made. Boddy (2016), Guest, Bunce, and Johnson (2006) and Mason (2010) suggested that a sample size of 12 provides a critical number of participants for an adequate purposive sample and good saturation. Latham (2014), however, believed that saturation often occurs between 12 and 15. My initial plan was, therefore, to interview 12 participants. However, during the final selection of my interviewees, I included two additional respondents. The justification for increasing the number of participants from 12 to 14 was that it allowed for a purposive sample representative of all student ages, levels and locations. The selection criteria were that the participants integrated EET into their pedagogy and preferably had some exposure to the most recent developments in EET. Should a large pool of applicants for interviewing have applied, selection would occur by engaging those who integrated the most current EET practices in their pedagogy.

The 14 participants for the interview, eleven from Kelston Deaf Education Centre and three from van Asch Deaf Education Centre, received ethics-approved documentation about the interview process and purpose. This documentation included a consent form whereby participants could indicate their voluntary willingness to

participate in the research. On completion of the interviews, I sent the participants their transcript so that they had the opportunity to review and amend the text. I endeavoured to maintain confidentiality at all times during this process. I identified each participating teacher by using the letter T and a reference number from 1 to 14. This means of identification ensured that direct quotes were not attributable to individuals and that all potentially identifiable references would remain anonymous. Each of the 14 interviews addressed the same nine interview questions (Appendix D). As the teachers involved in the interviews were either hearing (9), deaf (3) or hard of hearing (2), English and New Zealand Sign Language were the two primary languages of communication. Data from the 14 interviews offered insights into individual experiences and perceptions, which reflected the diversity of teachers' experiences and skills. The interview protocol concentrated on the personal experiences, practices, attitudes and commitments of these teachers to EET as a resource to support, extend and enrich the students' language development, student-centred inquiry, and social growth (Starman, 2013; Tschannen-Moran & Barr, 2004).

I used both New Zealand Sign Language and English to provide advice on the purpose of my research to the Board of Trustees, the principals, and participants of the two deaf education centres. In two instances, a New Zealand Sign Language interpreter was present during the interviews. During those occurrences, video recordings ensured the accurate follow-up of communication. My initial contact with the participants also specified the location and duration of the survey and interview; the use of the participants' data; and accommodating change that may occur during the course of the research (Hammersley & Traianou, 2012; University of Newcastle, 2017).

Table 7 details the demographic data of the research participants. Responses to the first four survey questions provided nominal variables on teaching position, gender,

the teaching qualification and qualification for teaching students who are DHH. Seventy-nine teachers out of a cohort of 163 teachers responded to the survey, giving it a 60.8% response rate. These teachers, distributed across the two deaf education centres, represented all school-aged students' educational levels. The majority of responses came from the itinerant teachers (65 out of 79 respondents). These peripatetic teachers make up the most substantial proportion of teachers for students who are DHH in New Zealand.

Table 7

Demographic Data of the Research Participants (2018)

Distribution of teachers	Responses	Percentage
Pre-school	1	1.3%
DHH provisions located in mainstream schools	12	15.2%
Resource teachers of students who are DHH	65	82.2%
Transition (Post school)	1	1.3%
Gender	Responses	Percentage
Female	68	86.1%
Male	11	13.9%
Geographical location of interview respondents	Number	Percentage
North Island of New Zealand	10	71.4%
South Island of New Zealand	4	28.6%
Completion of teacher training	Responses	Percentage
Before 1997	45	57.0%
1997 – 2002	16	20.3%
2003 – 2007	8	10.1%
2008 – 2012	7	8.9%
2013 – 2017	3	3.7%
Currently completing teaching qualification	0	0%
Completion of postgraduate teacher training for students who are DHH	Responses	Percentage
Before 1997	13	16.3%
1997 – 2002	14	17.4%
2003 – 2007	10	12.3%
2008 – 2012	12	16.1%
2013 – 2017	17	21.2%
Currently training as a teacher of students who are DHH	7	8.5%
Training as a teacher of students who are DHH not yet commenced	6	8.2%

Table 8 shows data on the hearing status, distribution and experience of the interviewees. While most participants were hearing, there was also representation from those who are DHH. Most participants were teachers at the primary school level, and most had taught between 5 – 10 years.

Table 8

Hearing Status, Distribution and Experience of the Interviewees (2018)

Hearing status of interviewees	Participants	Percentage
Deaf	2	14.3%
Hard of Hearing	3	21.4%
Hearing	9	64.3%
Distribution of the interviewees	Participants	Percentage
Pre-school	1	7.1%
Caseloads Y1-Y13	9	64.4%
Provisions: Primary School	1	7.1%
Provisions: Intermediate School	2	14.3%
Provisions: High School	1	7.1%
Transition	0	0.00%
Experience of interviewees in DHH hearing education	Participants	Percentage
0 – 5 years	2	14.3%
5 – 10 years	5	35.7%
10 – 15 years	4	28.6%
Over 15 years	3	21.4%

Ethics compliance.

My ethics proposal for implementing an online survey and subsequent in-person interviews followed ethics approved processes and guidelines (Biros, 2018; Parsell, Ambler, & Jacenyik-Traweger, 2014; University of Newcastle, 2017). It received approval from the University of Newcastle’s Human Research Ethics Committee on 12 October 2018 - Approval Number: H-2018-0375. Appendix A presents the Board of Trustees’ approval to action my research. Appendix B has the information statement and the participants’ consent form. Appendix C displays the online survey, and Appendix D consist of the interview questions.

Participants in both the survey and interview were de-identified to ensure anonymity. Naming did not occur, other than for my organisation of the raw data.

Participants' informed consent was essential due to potential power dynamics and associated perceptions. These situations could result from me being in a managerial position or being the researcher conducting the interviews, or being a colleague of the participants (Ellis & Loughland, 2016).

Meeting the standards and requirements of ethical compliance ensured the dependability, reliability and trustworthiness required for my research (American Psychological Association, 2017; Creswell, 2014; Merriam & Tisdell, 2016). These standards supported integrity and quality and reassured the research participants of considerations to minimise any associated risks, vulnerabilities, potential harm or detrimental consequences (Fisler & Firestone, 2006; Gelling, 2016; Orb, Eisenhauer, & Wynaden, 2001). Further, these standards assured the participants of their right to respectful treatment, informed consent, confidentiality, anonymity, and privacy (Wilkinson, 2001). The standards also assured participants of the safe and secure handling, storage, retention and disposal of their data records, audio and video recordings of interviews, transcripts, and other relevant information (Bryk & Schneider, 2003; Creswell & Plano Clark, 2018).

Method

My method provided the strategy, steps and rules to implement the design. It required developing and implementing two research instruments, namely an online survey and an in-person interview, for collecting, analysing, and evaluating national quantitative and qualitative data (Creswell, 2009; Creswell & Plano Clark, 2018; Onwuegbuzie & Leech, 2006). This comprehensive data provided a complete representation and holistic perspective on the inferences, breadth, and depth of my research's topic and conclusions (Creswell & Tashakkori, 2007a). The online survey helped explain relationships between attributes that varied among the participants, while

the interview questions explored challenges raised by the research questions in more depth. The collected data allowed me to address my four research questions, provided evidence on the participants' experiences of professional learning, and revealed their views on the necessary leadership practices to integrate EET in their teaching effectively.

Four volunteers outside of the two deaf education centres piloted the survey before implementing the two research instruments. These volunteers provided written and telephonic feedback on the procedure's clarity and problems, accessibility, duration, and sequence of the survey instructions and questions. The volunteers were satisfied with the survey's layout and content and its ordering, arrangement, wording, phrasing, duration, and instructions to support the questions. They suggested simplifying some terms to match the vocabulary used in everyday speech. They had some questions relating to the procedure and practicalities of accessibility and implementation of the research instruments. Their feedback thus created an opportunity to check the accuracy of the research instruments' content. I then made the necessary adjustments and developed standardised instructions. The data from these pilot interviews also allowed me to determine if the data gained was appropriate and whether it answered and addressed the research questions.

After making the modifications, 163 teachers of the two deaf education centres in New Zealand received an e-mail with a web link invitation to participate in the online survey available for 12 days. For both research instruments, I assured the participants that there were no correct answers but that all responses were a means of understanding their views on the research topic.

Figure 20 provides an overview of the four aspects of my research method. First, the method provided the means to address the four research questions (illustrated in yellow). Second, my literature review further addressed the four research questions. My

literature review investigated global research trends in EET, the opportunities and challenges of integrating these technologies, professional learning on EET, leadership practices and theoretical frameworks that support teachers' integration of EET (depicted in blue). Third, developing my research instruments to address the four research questions (depicted in red) required progression through the stages of developing a methodology, design, methods, and data analysis (illustrated in yellow). Fourth, collectively the aspects enabled the process of triangulation to verify the accuracy of my data relating to the integration of EET by teachers of students who are DHH (illustrated as the central red, blue and yellow triangle).

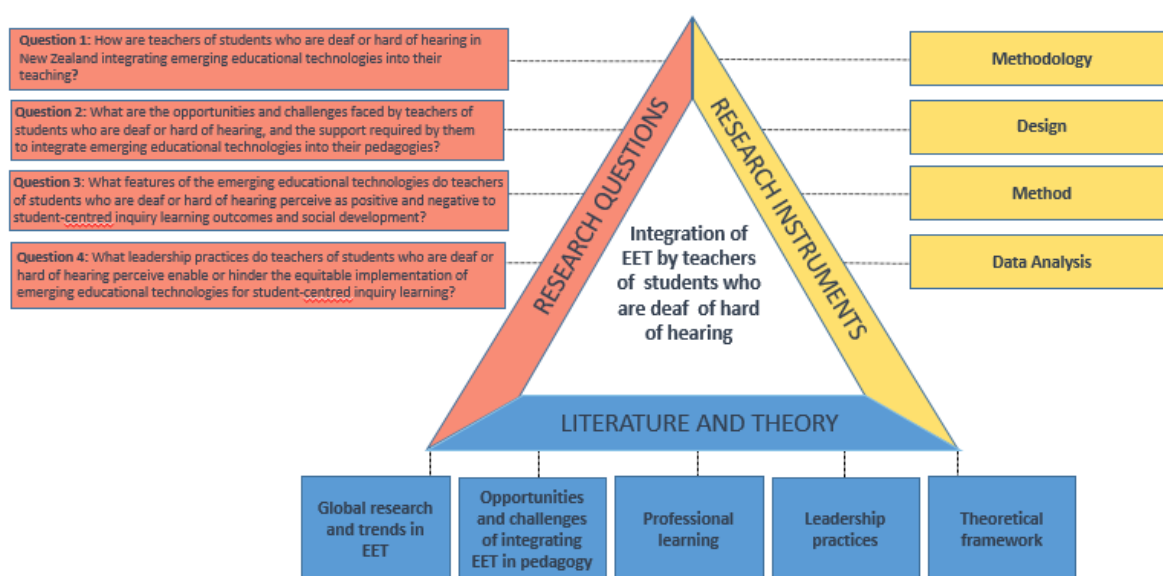


Figure 20. Elements of the methodology used to investigate the integration of EET by teachers of students who are DHH.

Instrumentation

I applied two research instruments to gather both quantitative and qualitative data. These instruments were an online survey and in-person interviews. The University of Newcastle's ethics committee and the board of trustees of the two deaf education centres endorsed the application of both instruments for data collection in this research.

Online survey.

The online survey (Appendix C) consisted of 17 questions to provide both qualitative and quantitative data. The Survey Monkey platform (SurveyMonkey.com) provided access for voluntary contributors. The survey supplied a link to a New Zealand Sign Language translation for those wishing to obtain this information through sign language (Napier, Lloyd, Skinner, Turner, & Wheatley, 2018). Further, it included an invitation to participate in an hour-long interview for an in-depth exploration of EET in teaching practices. After ethics approval, 163 teachers received the survey. The average time to complete the survey was 20 minutes.

Using a selection of questions requiring reliable responses from the participants was based on collecting information from a purposive sample of teachers. The survey design, describing the subject of my research, developed from explicit questions that arose as a result of my scrutiny and reflection of the four research questions. Therefore, the survey questions concerned providing data on teachers' integration of EET, the opportunities and challenges they face in their use of these technologies, identifying the benefits or not for student-centred inquiry, and perceived leadership qualities to support this practice.

The 17 survey questions consisted of 14 closed questions with quantitative nominal ratings and three questions requesting qualitative responses. Ten questions used the Likert scales to describe the responses, which ranged from higher or lower levels of agreement to measure the teachers' opinions or attitudes on items of interest (Carifio & Perla, 2008; Cohen et al., 2004; Creswell, 2014; Norman, 2010). Despite the ordered structure to these responses, the intervals between them did not necessarily indicate equal values (Jamieson, 2004). In terms of the survey's qualitative questions, participants nominated the apps and software programs they most frequently used, made comments

relating to professional learning, and expressed further comments or opinions regarding the use of EET in their teaching practices not covered by the survey.

The statistical analysis of data from the survey responses utilised three scales of measurement. First, a nominal (categorical) scale of measurement for categorical and assigned for naming purposes where the natural order did not matter. Each variable could belong to one group only, and numbers have no deeper meaning other than categorising and differentiating between the groups or objects to support the qualitative measurements of the interviews (Cohen et al., 2004; Creswell, 2014). Second, the ordinal scale indicated the naturally occurring order of the differences between items (Cohen et al., 2004; Creswell, 2014). Third, the interval scale of measurement showed the meaningfulness of each element's distance. The interval scale of measurement allowed for data ordering by attributes where differences are not measurable. However, the exact differences between values and successive points of variable distribution are unknown and could not be determined (Cohen et al., 2004; Creswell, 2014).

Both ordinal and interval responses were subjective, as what was likely for one respondent may not have been the same for another respondent. In my use of the ordinal and interval scale, there was no absolute zero, and the intervals between each grading were not necessarily equal (Cohen et al., 2004; Creswell, 2014). Further, the survey provided descriptive statistics. Patterns in the analysed data consisted of classifications (taxonomies) that seemed to fit together or relate to one another (LeCompte, 2000). The survey delivered biographic and demographic data of the participating teachers. It also focussed on two specific areas of interest: first, the teachers' engagement with professional learning in EET and second, the significance of leadership to support the teachers' integration of EET in their pedagogy. Collectively the responses provided a

diverse national overview of one point in time when teachers integrated EET in their pedagogy.

Interviews.

I developed the nine open-ended questions for the semi-structured interviews (Appendix D) from my informal observations of teaching practices inclusive of EET and information and understanding gained from the literature review (Kallio, Johnson, & Kangasniemi, 2016). The semi-structured approach was relevant to my situation, as I had only one chance to interview and gain a rich understanding of the participants' integration of EET in their pedagogy. The set questions guided and enabled me to follow through on relevant topical trajectories where the conversation strayed from the questions.

The justification for the semi-structured in-person interview is that I could prepare the questions ahead of time. Further, it allowed the participants the freedom to express their views on their terms. The in-person interview was best suited to gaining the participants' perspectives and obtaining representative data - that is unique to the experiences of the population under investigation - to address the research questions. Also, semi-structured interviews can provide reliable, comparable qualitative data (Dearnley, 2005; Husband, 2020; Kallio, Johnson, Pietilä, & Kangasniemi, 2016).

Responses to these interview questions provided data – in the participants' own words – from which I could develop insights into their views, attitudes and lived experiences of EET (Bogdan & Biklen, 2003; Cohen et al., 2004). Further, through this non-numerical qualitative data, I could explore all variables of interest to my research and find links to the fields of pedagogical practice indicated by the TPACK framework (Mishra & Koehler, 2006; Salmons, 2016; Yin, 2018). The interview questions consisted of an initial introductory question, followed by direct and indirect questions. There were

also questions requesting clarification or requiring deeper probing and explanation (Bloomberg & Volpe, 2012; Merriam & Tisdell, 2016).

I conducted 11 interviews via Zoom video conferencing, mainly from the site where the teacher worked. Three interviews occurred in-person. English was the medium of communication for 12 interviews and New Zealand Sign Language for two in-person interviews. The 14 interviewees were keen to share their responses and details about their views of the research topic. The process of interviewing members of the education of students who are DHH helped me understand past and present conditions and put into a broader context the interpersonal, social and cultural aspects of their circumstances (Erlandson, Harris, Skipper, & Allen, 1993). The interviews offered a means to explore situations where EET intervention had no single set of outcomes (Baxter & Jack, 2008; Richards, 2005; Yin, 2018) and understand the complex realities of technology innovations in schools (Ghesquière, Maes, & Vandenberghe, 2004). The interviews further allowed for the investigation of the challenges of EET integration, engagement with participants during my research, and the provision of a comprehensive data set (Kozleski, 2017).

The interviewees checked their interview transcripts before their data was analysed, synthesised, and clustered into codes and then themes. Further, the recruitment, retention and willingness of all participants' contribution to the research ensured its successful completion. However, the personal requirements of the participants took precedence over the research process. If at any time, participation placed the individual at risk or caused undue stress, that participant could withdraw without explanation, and no prejudice would occur. The option of further surveys or interviews provided substitute methods should there be attrition that might jeopardise my research's continuity and statistical conclusions (Baxter, Courage & Caine, 2015).

Data collection.

Data collection through the survey and interviews took place from mid-November 2018 to early January 2019. The purpose of data collection was to generate data for thematic analysis. Thematic analysis identified patterns of the participants' experiences, views, understanding, construction of meaning, and perceptions of EET integration in pedagogy. The thematic analysis provided a rigorous data familiarisation process, data coding, generating initial themes and theme development by reviewing and refining themes and defining and naming them. The means of thematic data collection placed me in a position to weave together the analytic narrative and data extracts and contextualise the data analysis concerning existing literature (Braun & Clarke, 2012). I used the collected data to seek answers to my research questions to contribute information to supplement the under-researched field and consequent limited empirical evidence in the literature on teachers' integration of EET in pedagogy for students who are DHH. In particular, the data collection intended to find, interpret and explain what worked and what did not work in such pedagogy. Data from the survey provided me with facts to support the interpretation of the interview responses. Additionally, the data collected from the interviews offered an opportunity for in-depth inquiry and findings. The data processing required software to analyse this and define the themes that became apparent through the data.

Software for data collection.

I used the computer-assisted qualitative data analysis software program NVivo 12 to analyse, code, and categorise the interview transcripts' collected data (Yin, 2018). NVivo accommodated word frequency queries and the organising, storing and retrieving of data through the various stages of findings. It further provided for the synthesising of

results. This synthesis supported the process of drawing conclusions and developing discussion and recommendations in the following three chapters of my thesis.

Process of data collection.

The use of explicit questions harnessed data that could otherwise become too broad and vast. Data collection required careful recording, analysis and interpretation of the survey responses, interview transcripts and the audio or video recordings of the interviews. As the primary agent for collecting and analysing the data, I began with the assumption that no data was trivial and that everything had the potential to unlock a more comprehensive understanding. Five themes and subthemes emerged from the process of data collection. To prepare for the thematic analysis and synthesis of the collected data, I recursively reflected on and actively engaged with the four research questions and the purpose of this research to discover how the data from the five themes and subthemes addressed my research questions and accomplished my purpose. During the collection and interpretation of the data, I also strove for awareness of personal biases. The absence of research on my topic meant that I worked beyond the security of an established body of research. As such, the requirement for critical self-reflexivity regarding the collected data was crucial. This continual self-reflection on the analytical process helped me clarify and reformulate the data (Cohen et al., 2004; Richards, 2005).

Themes.

After the data collection, I familiarised myself with this information through repeated readings of the transcripts. To discover themes in the data, I analysed keywords, studied where the interviews' narratives were similar to or differed from one another, identified words and phrases showing a relationship between things, and searched for missing themes and information (Richards, 2005). From this process of conceptualising,

classifying and categorising, five generic themes and interrelated connecting subthemes emerged.

The first theme and its subthemes related to pedagogy and the participants' integration of EET, their access to EET, and their frequency of engagement with these technologies. The second theme and its subthemes focussed on EET and concentrated on hardware, software and apps. The third theme and its subthemes recognised the opportunities and challenges that the participants experienced concerning EET. The fourth theme and its subthemes identified professional learning opportunities as a requirement of the effective integration of EET in pedagogy. The fifth theme concerned the contribution of leadership for equitable centre-wide integration of EET. The subthemes regarding leadership for integrating EET included their role in change management, budget provision, communication, collaboration, and meeting the teachers' grassroots requirements. These five themes and subthemes are discussed in-depth in Chapter Four.

Data analysis

I used is the thematic data analysis process allowing for the interpretive phenomenological analysis for content and meaning of qualitative data on the lived experience of teachers' integration of EET in their pedagogy of students who are DHH. The examination of the extensive collection of data from the 14 interview transcripts and results of the open-ended questions in the survey allowed for the content analysis of the interview's specific qualitative questions and the survey's open-ended questions. The analysis provided the means to sort and group useful facts, identify keywords, patterns, categories, themes and trends for re-grouping the data into codes and tables and constructing a context for communicating the essence of what the data revealed on my

topic (Richards, 2005). I clarified the coding levels and explained the process of triangulation (Castillo-Montoya, 2016; LeCompte, 2000; Webb, 2015).

The data analysis alone, therefore, did not provide answers to research questions. Instead, answers came from evaluating and interpreting the patterns and frequency of the content of words, phrases and images of the analysed data (Creswell & Plano Clark, 2018; Richards, 2005). The logic in categories and themes were abstracted, interpreted, and connected to the research's purpose (Graneheim, Lindgren, & Lundman, 2017). Data analysis also allowed for identifying more profound underlying interpretations and meaning (Creswell & Plano Clarke, 2018).

The application of qualitative content analysis for this research is justified because it is an autonomous method for use at varying levels of abstraction and interpretation (Graneheim et al., 2017). It generates a rich understanding of people by maximising the data outcomes' integrity and ultimate usefulness (Roller, 2019). Careful and accurate use of the qualitative data analysis process supports authentic, insightful, actionable and usable results. The justification for the qualitative content analysis method of data is that it provides a means of unpacking and analysing data to explore and give insight into the personal experiences and commonalities of how the participants, who are representative of teachers of students who are DHH, integrated EET in their pedagogy (Graneheim, Britt-Marie, & Lundman, 2017).

Process of analysis

After the thematic analysis of the data collection, I focussed on maintaining the unbiased process of gaining meaning from the data on my topic and a theory of practice, which, in the case of my thesis, was the TPACK framework. The data analysis process required familiarising myself with the data by engaging with the collated data to achieve comprehensive insight and understanding of the responses (LeCompte, 2000). I

progressed through the stages of data reduction, data display, data transformation, data correlation, data consolidation, data comparison, and data inclusion (Onwuegbuzie, Collins, & Frels, 2013). Though not central to the research, the demographic and biographic data helped contextualise the findings and formulate appropriate recommendations.

As the collected data were predominantly qualitative, I mainly applied inductive reasoning to generate meaning from the participants' narrative descriptions. The thematic analysis's inductive approach allowed for coding and theme development directed by the reality created by the data's content (Braun & Clarke, 2012). I further applied inductive reasoning to identify, categorise, and compare recurring patterns, themes, and specific principles, which I then placed into emerging, minor and major themes and relationships (Suri, 2011). I checked deviant accounts – which were exceptional, inconsistent or contradictory to the patterned regularity of responses – with the relevant interviewees to affirm my understanding of their responses (Merriam & Tisdell, 2016; Richards, 2005). I applied deductive reasoning to the online survey's limited objective quantitative questions to analyse numerical estimations and statistical inferences. My analysis process required constant comparison to ensure reliable coding, categorising and content analysis of the data's meaning (Merriam & Tisdell, 2016; Richards, 2005; Yin, 2018).

Levels of coding.

After data collection, the analysis of data from the two research instruments progressed through three levels of coding to ensure rigour, precision and consistency in the process of exploring the coding (Richards, 2005) (see Figure 21). These levels commenced with the open coding in which the labelling of codes and concepts and the clustering of recurring categories occurred. The second level required axial coding to examine the analysed data to find and reveal categories and subcategories. The third

coding level, selective coding, allowed for selecting core categories (Braun & Clarke, 2012). The boundaries between one type of coding and the next were not always rigid, but most coding took place in a linear sequence.

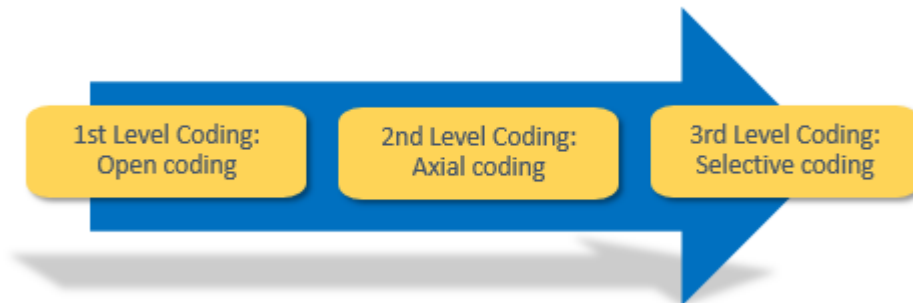


Figure 21. Levels of data analysis.

Open coding.

In the first or primary coding level for quantitative and qualitative data analysis, I extracted data to identify those trends, recurring patterns and structures, which reflected the participants' views. The primary coding application allowed for managed and organised analysed data on my research questions (Saldaña, 2009). Generative categories developed from recurring clustering patterns and the repeated commonalities amongst the participants' observations. Meaning expressed by one participant helped enhance my understanding and make sense of what came next from another participant (Holton, 2007; Williams & Moser, 2019).

At this primary level, I manually prepared the data from each line of the 14 interview transcripts by using colour markers to highlight tentative, emerging and recurring patterns and commonalities among participant responses. These highlighted responses could potentially become themes and subthemes for coding. Primary level coding gave me the necessary time to familiarise myself with the raw data. I could code, recode, categorise, and index the data to create a framework for the structure and definition of the information. I then uploaded these primary level investigation findings

into the NVivo 12 software program as emerging themes (using parent and child nodes).

This action prepared me for the second level of data analysis, namely axial coding, to link data to an existing parent or child node, or code it with a unique new node.

Axial coding.

The second level of coding, also known as axial coding, involved becoming increasingly selective in the juxtaposition and rearrangement of categories to find links and connections between themes and merge and cluster related themes (Holton, 2007; Saldana, 2009). Axial coding entailed reading and rereading the data to best group and code the emerging patterns. Further, axial coding involved breaking down the primary coding patterns into discrete parts, carefully examining them, comparing them for similarities and differences, and questioning the phenomena that they reflect. This coding involved noting how one participant's expression might converge and fit into a chosen theme, while other statements might diverge and indicate a deviation from this theme (Saldaña, 2013; Williams & Moser, 2019). Further, I used NVivo word-counts of the transcribed interviews as a secondary check for additional codes or categories.

Selective coding.

The third and final coding level involved winnowing all the data and reducing it to manageable sets of themes to write into the final narrative (Holton, 2007; Saldaña, 2013; Williams & Moser, 2019). During this process, five themes crystallised, each with its own set of subthemes. Chapter Four shares an account of these five themes. These themes include EET in pedagogy, identification of certain EET, opportunities and challenges of integrating EET in education, professional learning required by teachers to integrate EET in their teaching, and leadership support for the meaningful and sustained EET integration in pedagogy. I used a mind map to visually organise my data and help ascertain and organise this information into themes. By utilising a mind map, I could

visually organise the data from the first and second data analysis stages. Further, the mind map exposed the relationship between parts of the whole by revealing links and direct correlation to codes and quotes (Crowe & Sheppard, 2012; Guerrero & Ramos, 2015).

The results in Chapters Four, the discussion in Chapter Five, and the recommendations and conclusions in Chapter Six include selected participants' quotes as examples of their perspectives on specific issues relating to integrating EET in teaching practices. Selective coding was further necessary as it addressed topics of interest in my research, everyday experiences that the participants expressed, and reflected the unique needs of teachers of students who are DHH in the educational context of New Zealand.

Triangulation of data.

I applied the process of triangulation to seek convergence of results from the literature, the TPACK framework (Koehler & Mishra, 2009; Mishra & Koehler, 2006), the survey and the interviews to corroborate my findings (Abdalla et al., 2017; Creswell & Plano Clark, 2018). The survey and interview questions were individually analysed and triangulated against the four research questions. This triangulation considered all the available quantitative and qualitative factors from the thematic analysis (LeCompte, 2000; Pine, 2009; Rowe, 2000).

Triangulation provided a means to enhance the reliability of my findings. I was able to compare different sources of evidence to determine the accuracy of specific information. Triangulation allowed for in-depth exploration, comparison, contrasting and corroboration of the reliability of data gathered from the literature, online survey and interviews (Creswell, 2014; Yin, 2018). The resulting convergence of evidence confirmed the context, linkages to broader issues, accuracy, credibility, and trustworthiness of the data, thereby assisting reliability by the minimisation of bias and

the maximising of reliability and accuracy of information and findings (Creswell & Plano Clark, 2018; Merriam & Tisdell, 2016).

The convergence of data verified the usefulness, completeness and reliability of the information during the stages of interpretation, deduction, and formulation of drawing credible conclusions of the research findings (Adami & Kiger, 2005; Carter et al., 2014; Oliver-Hoyo & Allen, 2006). The analysis of the triangulated data considered the absolutes of objectivism. Triangulated data further accepted varied subjective personal interpretations, actions and experiences (Cohen et al., 2004; Houston, 2002). The triangulated data provided the source for the findings, discussion, conclusions, and recommendations in the following three chapters of my thesis (Cohen et al., 2004; Creswell, 2014).

Assumptions

I made three assumptions during the development of this study. First, participants completing the survey and those taking part in the interview would provide a reliable recording of their viewpoints and opinions. Second, those completing the survey would do so once only. Third, participants would honour the research's integrity by keeping the contents of the questions confidential and not discuss their responses with colleagues or others.

Scope

This research's scope included an investigation of the integration of EET by teachers of students who are DHH in New Zealand. As such, this study's scope covered only the parameters and geographic domain of New Zealand, as seen through the purposive sample size of the voluntary online survey and interview participants at one point in time. It, therefore, excluded a broader geographic reach, research population and multiple applications of the research instrument.

Delimitations

The delimitations narrowed the scope of my study and prevented a broader investigation. They provided for the identification of contexts to create a meaningful theoretical grounding. Delimitations further supported the focus on teaching practices inclusive of EET in the education of students who are DHH. I chose the online survey and the in-person interviews as instruments to best suit data gathering in a mixed methodologies research design. Timing of the research instruments' application was limited to approximately 20 minutes for responses to the online survey questions and about one hour for each in-person interview. This delimited timing was to respect the demanding work schedules of participants. I delimited the financial resourcing by making this a study about EET that teachers had access to and ensuring that video call links were available for interviews to limit travel expense and time.

Summary

In this chapter, I discussed the rationale for my research methodology design and methods to address my four research questions on integrating EET in pedagogy by teachers of students who are DHH in New Zealand. Ethical compliance, relating to the implementation of the research instruments, ensured participants' rights to respectful treatment, informed consent, and anonymity. I commenced this chapter by describing the research design, which included defining the research population, the purposive sample size and the research setting. I then explained the research instruments used to obtain, collect and analyse the gathered data. I described the procedures used for data collection, analysis and synthesis, which involved clustering data into identified recurring patterns and axial coding to arrive at the themes. As part of the methodology, I addressed the assumptions, scope and delimitations of this research. Chapter Four reveals the results of my study on the integration of EET by teachers of students who are DHH.

Chapter Four: Results

Kaua e rangiruatia te hāpai o te hoe; e kore tō tātou waka e ū ki uta: Don't paddle out of unison; our canoe will never reach the shore. (New Zealand Ministry of Education, 2020. p.2)

In this chapter, I present the data results of my explanatory sequential mixed methodologies on New Zealand teachers' views, experiences, and integration of EET in their pedagogy when teaching students who are DHH. I used the qualitative data gathered in the second phase of data collection to follow-up, refine, probe, extend and explain the initial general quantitative data collected during the first phase (Creswell, 2014). The data ultimately aimed to address my four research questions:

Question One: How are teachers of students who are deaf or hard of hearing in New Zealand integrating emerging educational technologies into their teaching?

Question Two: What are the opportunities and challenges faced by teachers of students who are deaf or hard of hearing, and the support required by them to integrate EET into their pedagogy?

Question Three: What features of emerging educational technologies do teachers of students who are deaf or hard of hearing perceive as positive and negative to student-centred inquiry outcomes and social growth?

Question Four: What leadership practices do teachers of students who are deaf or hard of hearing perceive as enabling or hindering the

equitable implementation of emerging educational technologies
for student-centred inquiry?

I identified five themes in the data related to the participants' integration of EET: pedagogy, use of various EET, opportunities and challenges of these technologies, professional learning, and leadership. The tables in this chapter present the quantitative survey data and show participants' engagement with EET for their pedagogy. Simultaneously, interview quotes arising from the qualitative data contribute detail to these results.

Interestingly, all participants predominantly used the term 'technology' or occasionally 'educational technology' rather than 'emerging educational technologies'. They spoke of technology and educational technology as singular rather than the plural term 'technologies'. For the writing of my research, I used the plural term 'emerging educational technologies'. Also, the participants spoke of 'deaf and hard of hearing' or 'hearing impaired students' rather than the term 'students who are deaf or hard of hearing' as used in this study. Further, the participants spoke of 'professional development' whereas I used the term 'professional learning'. Professional development is associated with on-time workshops, seminars, or presentations and typically addresses the group as a whole. On the other hand, professional learning intends to be interactive, sustained, and customised to the teachers' requirements (Brooks & Gibson, 2012; Webster-Wright, 2009). In this study, I embrace a professional learning mindset, inclusive of professional development events.

Background

I gathered both quantitative and qualitative data from a research population of 79 survey participants in mid-November 2018 and qualitative data from 14 interview participants in the period from end-November 2018 to early January 2019. I used tables

to visualise the quantitative statistics and quotes from the interview questions to narrate the qualitative data results, to provide generalisations and conclusions of both the survey and interviews (Creswell, 2014; Mason, 2006; Scott, 2007).

For quantitative data in the online survey, I used Likert scales to rate the participants' level of integration of eight carefully chosen EET in their teaching practices. These eight technologies included portable digital devices to accommodate software and apps, broadband for Internet streaming, digital games, augmented reality, artificial intelligence, virtual reality, robotics, and digital analysis software. I based the selection of these eight EET on technology trends identified by Core Education (2017a, 2017b, 2017c) and New Media Consortium (2017) for the year 2017 when I developed my survey. Participant responses regarding their experience of EET ranged from nil, never or not applicable through to advanced or higher usage (Appendix C). I also used Likert scales to identify the participants' perceptions of professional learning and essential leadership practices for meaningful and sustained EET use to support, enhance and enrich pedagogy.

The qualitative interview data results originated from 14 interviews I conducted with voluntary survey participants to expand on the results already gathered through the survey. This chapter includes quotes from the 14 de-identified participants (referred to as T1 to T14) to support the collected data. Triangulation of the quantitative and qualitative data and literature provided the means to validate the findings (Carter et al., 2014; Onwuegbuzie & Leech, 2006).

In the remainder of this chapter, I discuss the five themes. The first theme of pedagogy reflected on the views, knowledge, experience and practices of the participants' use of EET in their pedagogy. The second theme on integrating EET examined various educational technologies that participants included in their pedagogy to

support, enrich and accelerate their students' learning progression. The third theme related to the opportunities and challenges of EET in pedagogy. The fourth theme concerned professional learning that teachers required to enable the purposeful implementation of EET in their pedagogy. The fifth theme concerned leadership practices to support teachers' integration of EET in their education of students who are DHH to enhance language development, learning progression and social growth.

Theme One: Pedagogy

This theme revealed ways in which participants used EET to support and enhance their pedagogy and teaching responsibilities. The majority of participants held similar views on their experiences of integrating EET and its impact on learning. All 14 participants discussed how rapidly evolving technologies had become part of their teaching journey. This theme encompassed three subthemes. The first and second subtheme determined the participants' level of use of the eight selected EET and their access to these. The third subtheme considered the purpose of integrating EET in pedagogy for instruction, planning, preparation of teaching, and communication. Other purposes were to meet administrative and organisational requirements, student assessment and data analysis, and recreational and creative use.

Level of use of eight EET in pedagogy.

Table 9 indicates the frequency of the 79 participants' use of eight EET, namely 1) portable digital devices 2) broadband for interaction across distance 3) digital games 4) augmented reality 5) artificial intelligence 6) virtual reality 7) robotics, and 8) data analysis software. The table's data identified a range of results from non-use of particular EET to advanced usage, where participants integrated certain EET proficiently and creatively.

At the time of this research, the majority of participants described themselves as regular users of EET. They were familiar and competent with portable digital devices, broadband and digital games, but their integration of trending EET was low. Only a minimal number of participants were regular or daily augmented reality users, artificial intelligence, virtual reality and robotics. However, through the initiative of early adopters, these technologies were experiencing a tentative up-take.

The small number of participants using data analysis software referred to the recently introduced KAMAR student-management database system for school administration, marking assessments and reports. A majority of participants did not use data analysis software. 31.7% of the participants believed that they could perform the essential functions of collecting and assessing students' data through the data analysis software but still required support in using advanced features.

Table 9

Level of Experience in the Use of Eight EET (2018)

	EET	Non- user	Beginner	Regular user	Advanced	Total participants
1.	Portable digital devices	5.1% n=4	6.3% n=5	65.8% n=52	22.8% n=18	N=79
2.	Broadband for streaming	12.7% n=10	27.8% n=22	43.0% n=34	16.5% n=13	N=79
3.	Digital games	15.1% n=12	38.0% n=30	45.7% n=36	1.2% n=1	N=79
4.	Augmented reality	73.4% n=56	24.1% n=19	2.5% n=2	0.0% n=0	N=79
5.	Artificial intelligence	77.2% n=61	19.0% n=15	3.8% n=3	0.0% n=0	N=79
6.	Virtual reality	72.2% n=57	25.3% n=20	2.5% n=2	0.0% n=0	N=79
7.	Robotics	82.4% n=65	15.1% n=12	2.5% n=2	0.0% n=0	N=79
8.	Data analysis software	55.7% n=44	31.7% n=25	12.6% n=10	0.0% n=0	N=79

Also, the interview data revealed that participants' integration of EET in their day-to-day pedagogy traversed a range of views. Most participants stated how their experience of EET came through their teaching journey. T13 reflected on the introduction of computers for teaching to the deaf education centre and their major transformation in size, weight, cost, functionality, efficiency and accessibility. Regarding this integration, T13 further described it as an enormous leap of faith by all people

worldwide: “The integration of technology required a quantum leap for teachers and children”. T4 described the experience of integrating EET in pedagogy:

It's about using technology in the right way for the right thing. As a teacher, it's having the learning to make sure that you guide in the right way. I'm still on that journey. It's a very big journey to be on. (T4)

The data further showed the levels of all participants' engagement with EET for curriculum teaching, planning, communication, administration, assessment practices, recreation and occasionally creativity. Most participants indicated that their involvement with EET was mainly a means to enhance rather than transform student learning. They did not necessarily use EET as a resource to teach differently or take outside the class situation. They, therefore, had limited experience of connecting with students in other locations to encourage extended communities of learning, online communication and collaboration. However, participants unanimously believed that good teaching determined the effectiveness of the integration of EET. In this regard, T9 stated, “My fundamental belief is that pedagogy drives technology. It comes down to relationships and knowing the learners”. T14 explained this belief as:

I've always been a very strong believer that technology is not a babysitting tool, but provides teaching devices for a new way of teaching, a new way of doing things and new ways for self-directed tasks. You need a combination of good teaching to go alongside the use of technology to improve learning outcomes. (T14)

Further to this context, T10 stated, “Technology is not a magic item, and it's not something that just because you've got the technology, you are going to get positive outcomes from”. T12 stated, “In my use of technology as a teacher, I try and find a balance between the two – technology and direct teaching”.

While most participants showed low levels of integrating trending EET in their pedagogy, two participants appeared to use these technologies at an introductory level. These two participants mentioned their recent experiences in digital gaming, robotics, virtual reality and artificial intelligence. One of these participants discussed having organised the loan of a virtual reality kit for demonstration purposes. This participant described the reaction of students to virtual reality as:

The experience that we had in virtual reality from these three-dimensional glasses was so amazing. We could actually see things differently through these particular tools, and it had a huge impact on the students. (T7)

Interview data showed that one participant had used augmented reality, artificial intelligence, virtual reality, robotics and digital analysis software in postgraduate digital technology studies. Further, an award received by another participant to join in research workshops on EET had introduced this person to augmented reality, artificial intelligence, virtual reality, robotics and digital analysis software. All other participants did not have exposure and experience in the usage of augmented reality, artificial intelligence, virtual reality, and robotics in their pedagogy.

Participants' access to EET.

Table 10 indicates the 79 participants' access to EET for their students and themselves and access to technical support personnel at the school or provision where they work.

Table 10

Participants' Access to EET (2018)

Access to EET	No access	Infrequent access	Weekly access	Frequent access (daily)	Total participants
Students' access to EET	22.3% n=18	25.4 n=20	30.9% n=24	21.4% n=17	N=79
Teachers' access to EET	12.6% n=10	21.4% n=17	26.8% n=21	39.2% n=31	N=79
Teachers' access to technical support personnel	10.1% n=8	68.5% n=54	13.9% n=11	7.5% n=6	N=79

The results show that about half the respondents reported that their students have either no or infrequent EET access. The remaining respondents' students can access EET weekly or at any time. This discrepancy may result from geographic dispersion, remote locations or socio-economic status of the school community. The level of EET provision in the school or unit that students attend appears to impact the extent of its integration.

Over half the participants access EET weekly or more frequently. However, other participants indicated infrequent access. The majority of participants pointed out that they either required infrequent or had low access to technical support personnel. Only 13.9% required access to technical support personnel weekly, and 7.5% indicated that they accessed this service more frequently. Just over 10% reported no technical support access, indicating that this is a matter for further investigation.

To ensure equitable distribution of EET and matters related to this, T14 held that the opportunities provided for mainstream students required adaption for students who are DHH:

I think first and foremost that anything that's used in the mainstream can be adapted to be used with deaf and with hard of hearing students. So anything that

works in the mainstream, on the whole, would be able to be adapted for deaf and also hard of hearing students, which is fantastic because there's so much out there. (T14)

Purpose of integration of EET in pedagogy.

Table 11 demonstrates the frequency with which the 79 participants integrated and used EET for instructional, planning, communication, administrative, assessment, recreational, and creative pedagogical purposes.

Table 11

Frequency of Use of EET During the School Year (2018)

Use of EET	Quarterly	Daily	Weekly	Monthly	Never
1. Instructional purposes	1.3%	55.7%	35.4%	6.3%	1.3%
2. Planning and preparation	3.8%	68.4%	21.5%	3.5%	2.8%
3. Communication	0.0%	79.8%	17.7%	2.5%	0.0%
4. Administrative and organisational requirements	0.0%	86.1%	13.9%	0.0%	0.0%
5. Student assessment and data analysis	1.3%	20.3%	56.2%	20.9%	1.3%
6. Recreationally	12.3%	15.2%	46.6%	15.2%	10.7%
7. Creatively	5.1%	29.1%	53.2%	7.1%	5.5%

Regarding instructional purposes, most participants indicated high daily and weekly use of EET when teaching students as a whole class, in groups or one-on-one. Some participants mentioned the importance they placed on maintaining a balance of technology-assisted education and real-life experiences. T12 stated, “In my use of

technology as a teacher, I try and find a balance between the two – technology and direct teaching”.

All participants viewed the opportunities provided by EET as an essential daily and weekly resource for their preparation and lesson planning. Participants indicated that EET supported the development of problem-solving skills and personalised and accelerated learning. Regarding personalised learning, T9 said:

What makes the integration of technology work in the education of students who are DHH is that the content can be efficiently personalised for individual learners. This is crucial for our students because they come with varying degrees of hearing loss and language competency. (T9)

Most participants reported that the integration of EET supported teachable moments and occurred when they taught curriculum subjects through student-centred inquiry. This integration additionally helped encourage a growth mindset and student independence. The statement by T4 captured the prevailing view:

In deaf education, I find using blended learning significant. The high school students and I are on the Internet all the time for researching, using YouTube clips to support the teaching and learning program that is happening at the moment. Without technology, I would find working with these students limiting. (T14)

Concerning communication, participants used EET to communicate with other teachers, students, parents, and stakeholders on a daily and weekly basis. T11 discussed the significance of the student-teacher learning relationship when using educational technologies to connect with families, “Access to all learning will always better the outcomes for their child’s education and identity as a deaf person. That’s where I try very hard to make a difference and support my students and their families”. T4 explained that

while it is exciting for students to share their learning with their parents by connecting home and school through technology, there can be limitations and barriers. Such barriers occur when parents cannot be contacted by mobile phone or if they do not have a computer or Wi-Fi at home.

Participants reported high daily and weekly use of EET for regulatory administrative and organisational requirements and duties. T1 stated, “I do find technology very supportive in the teaching and learning program”. T4 concluded that “There is still a way to go to optimise and strengthen EET in administrative systems, processes and pedagogy to support teaching practices”.

Participants used computer software and data analysis for formal and informal student assessment. This assessment occurred over and above mandatory non-digital evaluations. They used digital assessment to create diagnostic spoken and auditory language samples, reflect on students’ learning progression, and inform their teaching practices and outcomes. However, the participants were uncertain and ambivalent about assessing the actual influence and impact of EET on their students’ learning progression and their pedagogy. T2 suggested that this situation would make for meaningful further inquiry and research.

All participants used EET recreationally and creatively daily, weekly, or monthly for their students to play games and as rewards for completing work and acceptable behaviours. T10 stated, “Offering students a variety of different ways to support them is the way to go”. Just over half of the participants also used EET creatively every week to encourage expression and expand student learning. Regarding the creative use of technologies with a particular student, T13 concluded:

It was all very exciting because it worked, but I don't know that it worked because of the technology only. Where there is such improvement in learning and behaviours, I like to think it was a combination of technology and me. (T13)

Theme Two: EET

During the 14 interviews, all participants had the opportunity to detail their pedagogical use of the Internet and their integration of specific hardware, software and apps. The majority of participants stated their incorporation of EET had the potential to improve students' educational outcomes. These technologies appeared to support students' competence in vocabulary, writing, oral language, reading, songs, rhymes, social growth, well-being, self-confidence and collaboration with peers. T2 believed that both teachers and students were constantly learning more about technology, and as technology improved, it became more beneficial and engaging.

The most common reasons for the participants' integration of EET, as learning resources, were their visual and tactile qualities, which potentially supported the progression of the students' language and learning levels. Through clear understanding, the students gained an increased opportunity to comprehend learning without difficulty. Collectively, participants mentioned visual Internet images as including photos, pictures, icons, clip art, videos and three-dimensional experiences. Various participants believed that visual and tactile resources supported the retention of information and built on existing knowledge. Some participants mentioned the benefits for students' emotional and social growth through the use of visual images. In this regard, the use of pre-recorded or real-time video opportunities had positive significance. However, several participants raised their concern that EET's visual representations might cause distractions from learning. They emphasised that the relevance, appropriateness and quality of the visual resources are essential elements.

The use of EET also appeared to improve the motivation of students, engagement and enjoyment in goal setting and ownership of the learning process and learning activities. T1 discussed how EET provided resources for teachable moments when students struggled with a concept, such as working with money. T8 viewed technology as a vital communication tool for sign language, “From my perspective, the technology today is allowing sign language to get out there more and more, so it gives equal access”. The following section reflects the hardware, software, and apps identified in the survey and interviews. These are detailed and tabulated in Appendix E.

Hardware.

The digital hardware that participants mainly used were computers, laptops, iPads, Chromebooks, webcams, digital and video cameras, smartboards and smartphones. A few participants mentioned their use of a printer to print their technology generated work and resources. Interestingly only two participants spoke of data projectors and described their negative experience of this. In both instances, there were technical issues that hampered their use and proper application of this tool. Although not common practice at the two deaf education centres, two participants referred to virtual reality hardware and virtual glasses. These two participants stated that the devices provided three-dimensional, visual-spatial experiences of people, things, places and animals, which might benefit their students’ apparent preference for visual communication.

Software.

The software mentioned by participants included blogs, data programs, games and online gaming, e-mails, texts, and mobile phone calls. Most participants referred to Google functions. These included Google Classroom, Google Docs, Google Drive, Google Apps and Google Slides to present students’ inquiry topics. Some participants

discussed the recently introduced Microsoft Office 365 platform, which included a Team function that these participants used to keep updated on the progress of tasks within a group. While all participants did not commonly use augmented reality and virtual reality, one participant referred to software for implementing virtual reality in learning topics. Beyond this, access to information came via the Internet and resources. This access to information included websites, video clips, YouTube films, and Ted Talks. These resources potentially provided access for sign language users to experience New Zealand Sign Language and English stories, with captioning of videos allowing access to the audio presentation. Participants described Zoom video conferencing as increasingly invaluable for bridging geographical distance and setting up national in-person discussion between teachers and students.

Apps.

At the time of data gathering, participants used apps in their pedagogy to support the listening, language, reading, writing, content knowledge, mathematical, social skills, and assessment of their students. T1 described how the use of apps varied according to the requirements of the students:

My use of apps depends on my caseload at the time. If I've got a student with a particular need, I will aim to fill that gap. So in my planning, I'll be using a specific two or three apps to help me fill that need, and when that gap is filled, I move on to something else. So my use of apps varies depending on the needs of the students. (T1)

Theme Three: Opportunities and Challenges

All participants identified various EET opportunities as resources and practices to support, extend and enrich their pedagogy. While some participants expressed caution

about the use of EET, they all believed that integrating EET might provide positive opportunities for sharing and communication. T2 stated, “I think the biggest opportunity of technology for deaf and hard of hearing kids is language access”. T9 highlighted the opportunities provided through EET for “equipping learners to be contributing citizens and to be well equipped in the world that they currently live in”.

Participants identified six opportunities when integrating EET in teaching. These included EET for visual learning and educational games, scaffolded learning, social growth, the development of higher-order thinking, access to sign language, and the accumulation of portfolio information. Nine challenges that participants identified included lack of time to upskill in EET, equitable and sustained access to EET, relationships with the mainstream and host schools, replacement of leased technologies, geographical barriers, professional learning in EET, the possible negative impact of EET on students, the lack of EET in students’ homes, and matching EET to each student’s learning requirements. In the next section, I discuss these opportunities and challenges.

Opportunities.

The participants were mainly of the opinion that EET provided visual opportunities for teachers to nurture the students’ language development, provide access to new learning through student-centred inquiry and make connections for social interactions. These technologies assisted participants in moving away from infrastructure-led advances towards more student-led solutions. T10 captured this as:

Technology can enhance what you want to teach. It can take kids in directions, which support their writing, reading and numeracy. Through the technologies, they can develop very good communication skills in terms of interviewing somebody, or fact-finding or going to find information from someone else. (T10)

T10 further said, “There is such a variety of different things that you can use technology for and, depending on how you use it, you’re going to get different positive outcomes”. Below are the six opportunities that participants identified for integrating EET in teaching.

Visual learning and educational games.

All participants recognised that, in their context, “The features of technology lends itself to that visual aspect of using sign language” (T3). T4 said visual images through technologies supported coherence of learning and that “Visuals can spark the children’s interest or make them wonder”. Further, T9 explained that these visual features might encourage a creative learning environment that enhances student-centred and self-directed inquiry across all subjects.

Some participants highlighted the learning opportunities provided by games. According to these participants, games made learning an interactive and fun activity. They further noted that while games enhanced their students’ learning experiences, they also provided real-time feedback and assessment. T7 said, “There’s a number of subjects of the curriculum that can be covered by gamification and students can create their own games”.

Scaffolded learning.

T3 discussed how EET could benefit the specific learning needs of students who had little prior knowledge on particular learning topics. Through these technologies, T3 could scaffold the students’ development of problem-solving skills at teachable moments. Scaffolding thus supported clear instructions and expectations and encouraged the students to gain fundamental competencies in the topic of learning. Further, T11, like the other participants, concluded that EET created teaching and learning opportunities, which facilitated engagement, learning progression and achievement across a variety of learning

experiences. The application of scaffolded learning where needed required informed and consistent teacher judgement against the curriculum's goals.

Social growth.

Some participants discussed how EET connect students worldwide across distance, thus promoting language growth, collaborative learning, and social growth.

Regarding social growth, T11 noted:

The social development, social confidence and emotional needs of being deaf or hard of hearing at any level of school, but especially at high school, is difficult and should have good support. These students really have to work hard on being assertive and standing up for themselves, and ask for help when they need it.

(T11)

Development of higher-order thinking.

Some participants argued that EET offered their students opportunities to develop critical (higher-order) thinking skills. These participants discussed that higher-order thinking required their students to evaluate their learning, consider multiple viewpoints, and solve learning problems creatively. T10 stated, “With technology, you can bring kids to where they wouldn't normally respond”.

Access to videos using New Zealand Sign Language

Several participants observed that EET provided abundant opportunities to access and share New Zealand Sign Language videos. Several participants described the possibilities of using EET to connect parents, students and school using English and New Zealand Sign Language as modes of communication. They mentioned situations where parents could download or upload their child's learning stories, receive notices and letters, access assessment results and other relevant school-related information.

Accumulation of portfolio information.

A few participants discussed how they used specific software to keep a portfolio record and cumulative account of the evidence of their teaching practices required for their teacher registration. They described their personal portfolio as a rewarding accumulation of teaching and professional learning achievements and outcomes over time. The portfolio supported their reflection on the curriculum and assessments. This reflection allowed for improved planning of student learning and their professional learning. T12 concluded, “Technology can enhance what you want to do, and it can take kids in directions which they would in the past have failed in, such as writing and reading”. Data also indicated that a few participants perceived EET as providing potential career opportunities and postgraduate study pathways.

Challenges.

Despite the benefits identified above, the data results indicated six challenges concerning integrating EET into pedagogy. The dominant problem that emerged was the lack of time required to upskill in a particular technology to make it truly useful. Equitable access to EET was a further barrier, as was the participants’ relationship with the mainstream school or host school. Access to professional learning about EET was another challenge. Additional issues included the possible negative impact of EET on students and the challenges that leaders face when supporting EET integration in the school context. In this section, I discuss these challenges.

Lack of time to upskill.

Participants unanimously identified the challenge of not having enough time to explore, practice, experiment and learn about EET. They further stated how this lack of time prohibited reflection on new strategies that might support their pedagogy. Some

participants felt that lack of time prevented collaboration with colleagues, opportunities to delve into research, and space to develop an in-depth understanding of integrating and implementing current and new EET in their pedagogy. T6 captured this view as:

I think we need to set up a better system that whenever we are taught about technology, there is follow-up. You might need at least two follow-up sessions, or you might need someone to check on how it is going until you know how to implement it. Often I find out that I've got bits of stuff, but not the full picture.
(T6)

All participants found that they increasingly used more of their weekend time to stay abreast of technology changes and suggested that it was important for leadership to consider this situation. T2 commented:

I would be so grateful if somehow they [leadership] could give us a little bit of time during school time hours because all our evenings are filled up. I find that my Saturdays and increasingly my Sundays are being filled up. (T2)

Equitable and sustained access to EET.

All participants identified discrepancies in EET provision across the New Zealand education sector for students who are DHH. Equitable access to resources for students in provisions and mainstream schools posed a challenge for some participants. There was a sense of “always being on the back foot and playing catch up” (T9). While each student had an iPad in some locations, in other cases, there was only one iPad in the class. Having one iPad only did not support active learning.

Some participants described various situations where they had experienced a lack of equitable access to hardware, software, apps, resources and the Internet connectivity required for pedagogy in a digital world. These participants surmised that lack of equity might result from the student's particular school of attendance, socioeconomic status,

remote or rural location or additional disability. Some participants mentioned that they wished to see more apps and videos with New Zealand Sign Language and captioned subtitles embedded in these videos to ensure ease of access for their students to information. T8 identified this as a current and future vision, “I can see that growing – the world of sign language on the world-wide-web”.

Relationship with the mainstream and host schools.

Several participants mentioned the challenges they experienced as either an itinerant teacher of students who are DHH visiting mainstream schools or as a teacher in a provision attached to a host school. Both groups of participants experienced challenges such as the inability to access Wi-Fi for Internet use or the school’s reluctance to share login details. T6 discussed the administrative challenge of dealing with an overload of e-mails from their host school and the deaf education centres.

Itinerant teachers expressed challenges such as mainstream schools using a different technology to their preferred platform – either Microsoft or Apple – for instruction, collaboration and administration. The differing platforms required the itinerant teachers’ versatility across both. Two participants mentioned their disappointment about not having permission to access the professional learning on EET available to teachers of the mainstream schools. One participant expressed disappointment at the lack of regular follow-up by mainstream teachers with a DHH student in their class. Mainstream teachers reportedly liked the participants’ recommended strategies but often did not put these into practice. T5 recognised that this could result from the mainstream teachers' large workload and the challenge of fitting in anything additional yet concluded that:

I don't think half of the mainstream teachers know what our role is. These teachers do not understand how deafness, and not being able to hear, affects all

this other stuff and think these deaf children learn language through reading only.

(T5)

The data of T5 and T6 suggested other difficulties associated with using EET across the multiple schools they visited. They discussed the challenge of transporting their teaching and learning materials and devices from school to school to their caseload students. Further, they raised their concern about the responsibility for ensuring the non-misplacement of equipment.

Replacement of leased technologies.

Challenges also surfaced when the lease on specific technology equipment, such as laptops, expired. Some participants reported frustration with the potentially time-consuming process of replacement. A related issue occurred when newer devices had upgrades, which may not be compatible with the participants' technology requirements, for example, receiving a new iPad without the SIM card portal that teachers need for Wi-Fi access in certain schools.

Another challenge identified by T8 occurred when videos and apps were audio-only and did not include video captioning. Audio videos and apps without captioning required additional preparation time for teachers – who may themselves be DHH – to ensure that students received the same access as the hearing students at their school.

Geographical barriers.

A challenge that itinerant teachers, in particular, experienced with incorporating EET was the geographic dispersal of their students. All participants were aware that they could connect through platforms such as Zoom and Skype video conferencing. However, these technologies did not always work, or there were sometimes firewalls blocking transmission.

Professional learning in EET.

Several participants discussed the lack of opportunities for professional learning about EET, particularly in the educational context of learning for students who are DHH with its focus on language and communication access. They needed to adapt professional learning designed for mainstream students to the requirements of students who are DHH. These participants, therefore, felt they were primarily self-taught. T8 described this as follows:

I've learnt about the integration of educational technology on the run and used it in my teaching as the learning situations happen. I would say, "Ah, that's a really good idea. I'll use that!" But this is all of my own initiative. I've not been provided with any professional learning as such. So I'm just using what I think is best for the students' learning, but I'm not sure if I'm using it in the best way that is practical for students. (T9)

A related issue was not receiving professional learning for individual learning requirements. Four participants mentioned the challenge of "not knowing what you don't know" about EET and being uninformed of the availability and uses of current and new technologies to support the curriculum's delivery. T6 described this as, "It is hard not knowing what you don't know and not knowing who to go to, to find out how certain things work".

All participants commented on the challenges of the leaderships' decision to switch from one operating platform to another. They felt that they had not received adequate professional learning and follow-up for the efficient implementation of this. They described how they were still juggling their work between the Google and Microsoft platforms. This situation was confusing and required time to adjust. Most

participants said that the impact of this change had not received adequate strategic consideration nor provision for appropriate professional learning and personal support.

Possible negative impact of EET on students.

Inappropriate use of EET caused concern amongst some participants. In these instances, there was doubt about the capacity of EET to improve learning outcomes. These participants mentioned examples of inappropriate technology use. T5 described students' activity of cutting and pasting website information without understanding the content. Other unsuitable usage occurred when the technology did not match the student's particular skill level or was used as a time-filler. T8 expressed this concern by stating, "So the question is whether technology is beneficial or not in those instances as the technology itself could be a barrier to learning".

A few participants also discussed the occurrence of addictive behaviours when students used technologies for games and entertainment rather than learning tools. Some participants spoke of communication barriers resulting from the use of EET in teaching. Regarding this, T12 stated:

I find that with technology, people don't talk to each other. I can see that with technology, there can be situations where students are not talking or communicating directly. If I take the iPad off the students, they talk more. (T12)

Lack of technology in the home.

A further challenge occurred when students did not have access to technology in their home or their local school, which potentially affected opportunities to support their social growth, well-being or pastoral needs. T9 observed how students who are DHH "try to grapple with two worlds, the deaf and the hearing world at the school they attend" and how it is challenging to offer them the best of both worlds. T11 observed the students' need for support from both the home and the school to learn assertiveness skills and ask

for the required help. T11 went on to explain this as, “The social confidence and emotional needs of being a deaf person at any level of schooling, especially high school, is difficult and should have great support”.

Matching EET to students’ learning requirements.

T11 discussed that if not functioning effectively, technology might be disruptive to the students’ routines. A further challenge was matching appropriate EET to students’ different learning styles to make learning personalised, differentiated and meaningful. Such learning styles included a kinaesthetic, hands-on approach and required access to visual presentations. T9 stated:

Through technology, you can differentiate and personalise the content of learning and how you deliver this to suit the needs of different students. It comes down to pedagogy, and yes, you really have to know your students well. (T9)

For students with additional needs, the challenge was to find the best possible way to use EET to support their learning. T9 discussed the importance of teachers having the right skills, growth mindset, and creativity to teach in a modern learning environment. In such a context, EET are inseparably linked and thoughtfully aligned to pedagogy and learning content. Two participants had the experience of teaching in fully-fledged modern learning environments. T9 described this as:

It was totally different from what was happening elsewhere in the education of both deaf and hard of hearing learners. In a sense, it was really awesome professional learning on the job because you were thrown into that school situation where you had to facilitate learning for students who are deaf and hard of hearing in a learning setting like that. You had to learn fairly quickly, and you had to adapt very quickly. (T9)

Theme Four: Professional Learning

This theme focussed on the challenge of teachers' access to regular and ongoing professional learning in integrating EET in pedagogy. T3 stated, "Some form of training is necessary, otherwise we're not using the technologies". The statement of T4 reflected the view of all participants on this matter that, "The purpose of professional learning is acquiring ease of use in educational technologies". They unanimously identified the requirement for continued professional learning in this field. T1 captured this opinion by stating, "Certainly, being introduced to anything new about educational technologies through professional learning is totally invaluable".

Collectively participants identified that their professional learning about EET came through coaching, mentoring, and cascading of knowledge. A few participants identified that their professional learning came through collaborating in a community of practice, action research, and achieving recognised teaching standards or qualifications. Further, all participants believed that professional learning ensured equitable standards and access to the appropriate use of technologies for all teachers and students. Other purposes of professional learning included keeping updated with current and future developments in EET, and supporting the students' achievements in language development, learning progression and social growth.

Satisfaction levels of professional learning on EET.

Table 12 indicates the satisfaction levels of participants with their professional learning about EET. The majority of participants (42) were somewhat satisfied with the professional learning they received, while others were either satisfied (17) or unsatisfied (20). Significantly, no participants were very satisfied with their professional learning.

Table 12

Satisfaction with Professional Learning of EET (2018)

Satisfaction level	Responses
Very satisfied	0.0%
Satisfied	21.5%
Somewhat satisfied	53.2%
Unsatisfied	25.3%

Barriers to professional learning.

All participants reported that despite having specific skills in EET, they experienced certain barriers in their access and requests for professional learning and support. Table 13 indicates eight barriers that participants faced in their professional learning of EET. These barriers are the uniqueness of education for students who are DHH and professional learning to address changes in EET. Other barriers are providing professional learning at the mainstream schools that teachers of students who are DHH attend, the need for self-teaching, and time to absorb professional learning. Further barriers relate to strategic leadership, language focus, and professional learning not available in New Zealand. Table 13 also provides samples of participants' comments regarding these barriers to professional learning.

Table 13

Barriers Identified by Participant to Access of Professional Learning on the Integration of EET in Teaching

	Barrier	Participants' Comment
1.	The uniqueness of education for students who are DHH	We have to be very careful about making sure that we are utilising those applications that accommodate our uniqueness. I access the virtual network of learners, and so I am able to connect online with other educators. I'm noticing the similarities but also the uniqueness about organisations and education. I know that when I was telling them about things that we do in deaf education, they realised that it is so unique. (T7)
2.	Providing professional learning to address changes in EET	I tried to get some professional learning around the Smartboard, but I just couldn't find a source for it. Even the people that installed it, they didn't offer anything. They said I needed to contact some other place, and when I tried to contact them, it didn't lead anywhere. I wanted to find ways of using a Smartboard, having apps and things to use on the Smartboard, but I couldn't find anything no matter how hard I looked. (T3)
3.	Providing professional learning at mainstream schools, participants attend	We work with the school but not for professional learning. They have just had a whole lot of professional learning on digital coding with kids and using technology in the classroom. I would love to have something like this. (T14)
4.	Need for self-teaching	In most of the things relating to educational technology, I've been self-taught. (T14)

	Barrier	Participants' Comment
		<p>Sometimes I've gone away from training thinking I don't know how to do it, but I know it's out there. (T2)</p> <p>I did not receive professional learning opportunities. I just worked out my own ways of implementing technology in my teaching. I just came up with my own system and things that I had remembered from years before (T3).</p>
5.	Time to absorb professional learning	Also, time is a priority. I still think there is room where you can develop those independent problem-solving skills, and there needs to be time allocated where you can do activities that develop those skills. (T10)
6.	Strategic leadership	I'm sure that competence would grow if we had leadership in that area. (T8)
7.	Language focus	But a hindrance, I guess, is the access to PD that is suitable for deaf children as well. Quite often, you could go and do a course about something, but it didn't come from the same focus. We always come from that language focus. (T3)
8.	Professional learning not available in New Zealand	To get the professional learning that I needed, I had to go overseas because there wasn't any here, except for professional learning for regular classroom teachers. I went to those, but I had to always convert from regular classroom needs to deaf education needs, which is what teachers of the deaf do all the time. That's part of being a teacher of the deaf. (T13)

Professional learning sources in EET.

Participants discussed their sources of professional learning for the integration of EET in their teaching. Some participants expressed that they would value the attention to their requests for specific professional learning opportunities. These requests included targeted training on integrating specific EET for students who are DHH, training in assessment practices, attendance of relevant courses, workshops, summits, conferences, observations and visits. A few participants discussed their access needs to professional learning opportunities in consultation with their leaders. Some participants mentioned that they had accessed professional learning on EET independently and at their own expense.

Table 14 shows eleven sources of professional learning in EET. It also indicates the frequency with which the participants accessed these various professional development opportunities. Collectively these results suggested that exposure to professional learning, via the eleven identified opportunities, was either not applicable or low on a quarterly, monthly, weekly or daily basis. Some participants indicated that exposure to professional learning took place as a one-off event once or twice a year. All participants reported that they typically obtained their professional learning informally through discussion with colleagues and exchanged resources. Two participants indicated an unfulfilled desire to attend a conference relating to EET to gain current research exposure. Comments and observations from the participants on each of these professional learning sources follow on after this table (Table 14).

Table 14

Professional Learning Opportunities in EET Provided to Teachers by the Two Deaf Education Centres (2018)

Professional learning opportunities	One-off	Once or twice a year	Quarterly	Monthly	Weekly	Daily	Never
1. Courses	34.7%	48.0%	5.0%	0.0%	0.0%	0.0%	12.3%
2. Conferences, seminars, workshops	36.7%	26.6%	2.5%	2.5%	2.5%	0.0%	29.2%
3. Formal qualification	17.7%	2.5%	0.0%	0.0%	0.0%	0.0%	79.8%
4. Observations and visits to other schools, teachers and professionals	36.7%	12.7%	6.3%	0.0%	0.0%	1.3%	43.0%
5. Network of teachers	25.3%	11.4%	17.6%	5.1%	3.9%	1.3%	35.4%
6. Research opportunities	19.0%	7.6%	5.1%	2.5%	6.3%	1.3%	58.2%
7. Mentoring, peer observation, coaching	21.5%	19.0%	12.7%	3.8%	3.8%	0.0%	39.2%
8. Readings received from leaders	13.9%	19.0%	12.7%	15.2%	12.7%	1.3%	25.2%
9. Informal dialogue with colleagues	5.0%	24.1%	11.4%	26.6%	17.7%	7.6%	7.6%
10. Discussion and exchange of EET for teaching	15.2%	20.3%	17.7%	22.8%	15.2%	1.3%	7.5%
11. Activities across different age groups	22.8%	12.7%	3.8%	6.3%	3.8%	1.3%	49.3%

Courses, conferences, seminars and workshops.

T10 observed that “Keeping in touch with what is happening out there is important. I think seminars or workshops are really important”. T7 reflected:

I remember some fantastic professional learning. I went to the Google TechEd Summit. That had a huge impact on me because of so many educators that were there learning about the technological advances that we have in education available to us now through Google. Being able to see all of this displayed for us, and presented to us was really beneficial for our students. It just broadened my mind completely. It gave me a really good reflective look at myself and my practice and made me think in a different way about how we can utilise these tools to benefit our students. (T7)

Formal qualifications.

Another professional learning opportunity was through formal qualifications in EET, such as postgraduate study. T2 stated, “What's really helped me is working at Auckland University of Technology and having that one-to-one help”. Similarly, T7 observed that postgraduate training had been professionally valuable:

My Mindlab professional learning was a postgraduate diploma, and it was collaborative digital learning. It enabled me to focus on not specific areas and actually look across the board at what was useful. It supported me to think in innovative ways about modern methods of educating children rather than just going with the traditional ways so that we incorporate digital learning within the wider context of education for students who are DHH. (T7)

Some participants identified that desirable forms of professional learning included upskilling through the New Zealand Ministry of Education initiatives on EET. Three other participants mentioned the formal professional learning they had received through

these initiatives. These came from Cognition Education, an e-Fellow from Core Education and training with the Manaiakalani Cluster. This cluster is an education program intended for achieving significant improvement through full digital citizenship for students attending decile one schools in the Auckland suburbs of Glen Innes, Point England and Panmure. Decile one schools have the highest proportion of students from low socio-economic communities, whereas decile ten schools have the lowest percentage. The lower the decile, the more funding the school receives to overcome barriers to learning faced by students from lower socio-economic communities (New Zealand Ministry of Education, 2018e).

Observations and visits to other schools, teachers, colleagues and professionals, and participation in a network of teachers.

All participants indicated that colleagues were both instrumental and inspirational in terms of providing professional learning. T11 said, “I think my best introduction to technologies would have been when I was working alongside a deaf colleague. She was just really instrumental in saying that you need to make use of your computer skills”.

T4 discussed the value of one-on-one and small group learning for embedding new learning and added that, “Small group is great because then you can start discussing with other learners around you and build on your knowledge”.

T11 mentioned the refreshingly new professional learning received through teachers who have recently completed teacher training saying, “They are a wealth of knowledge! They’ve come through with all the latest technologies and the latest ideas around supporting students that are hearing impaired”.

Research, mentoring, peer observation, coaching and professional readings.

Further professional learning came from involvement in collaborative or individual research projects on a topic related to EET or by each centre’s support through

mentoring, coaching and peer observation. T11 spoke of two teachers who are deaf as being role models for the use of EET for students who are DHH.

For one participant, coaching came from a colleague who provided targeted EET support, “I really like the way the e-learning leader gave us one-on-one key support and strategies because it was targeted for the specific student, and it gave me more confidence just to keep going with it”. (T11)

Some participants concluded that professional learning also happened by reading professional literature – such as journals, articles, evidence-based papers and theses – and engaging in informal dialogue with colleagues on improving teaching practices.

Informal dialogue and discussion with colleagues.

Several participants noted that teachers and students learning from one another were other forms of informal professional learning. In this regard, T1 acknowledged that:

I absolutely learn much about technology informally through my colleagues. I find when we have time to share information, [it] is just so incredibly invaluable because we've all found little snippets that really worked well. So, rather than us all trying to reinvent the wheel the whole time, if we can be sharing that with each other, [it] is so good. Learning from each other is definitely invaluable.

One participant indicated that informal professional learning might even come from a technology salesperson.

Exchange of educational technologies and engagement in joint activities across different age groups.

Two further professional learning opportunities stemmed from discussions and exchanges with colleagues of teaching materials relating to EET and engaging in joint activities across different age groups. In both these instances, each teacher contributed their expertise in EET.

Impact of participants' involvement in professional learning about EET.

Table 15 indicates the impact of seven professional learning practices for implementing EET on participants. These practices included courses, conferences, formal qualifications, and observations followed by a discussion. Networking with educators, individual or collaborative research, and centre-wide professional learning on EET provided other professional learning opportunities.

Not all participants responded to each of these professional learning opportunities in EETas they may have considered a particular professional learning opportunity not to apply to them. The results show that 67 participants did not confirm their relevance or experience of the first practice (courses/workshops). Further, 47 participants did not confirm the relevance or experience of the second practice (conferences/seminars), 23 of the third practice (a recognised qualification), and 49 of the fourth practice (observation/visits). Also, 40 participants did not confirm the relevance or experience of the fifth practice (networking with other educators), 36 of the sixth practice (individual or collaborative research), and 71 of the seventh practice (centre-wide professional learning).

All seven professional learning practices influenced the participants to certain degrees. Participants indicated that courses and workshops had the most impact on their professional learning. Other professional learning that had a high impact on participants came through conferences and from observations and visits to understand the pedagogical use of EET in practice.

Only four participants reported a considerable impact resulting from qualifications in EET. The majority of participants who responded to this question viewed professional learning via a qualification as not applicable to them. Of significance is the number of participants who did not respond to the various opportunities for professional learning.

Table 15

Impact of Professional Learning in EET (2018)

Professional learning options	Negative impact	No impact	Impact	Large impact	Non-response
1. Courses/workshops	3.8%	8.9%	53.2%	19.0%	15.1%
2. Conferences/seminars	0.0%	8.9%	43.0%	7.6%	40.5%
3. Recognised qualification	0.0%	13.9	10.1%	5.1%	70.9%
4. Observations/visits	1.3%	8.9%	40.5%	11.4%	37.9%
5. Networking with other educators	0.0%	11.4%	34.2%	5.1%	49.3%
6. Individual or collaborative research	1.3%	12.7%	26.6%	5.1%	54.3%
7. Centre wide professional learning	7.6%	12.7%	49.4%	20.3%	10%

Frequency of engagement in professional learning opportunities.

Collectively participants concurred that the deaf education centres organised formal professional learning opportunities related to EET based on internal strategic planning or Ministry of Education requirements. On the other hand, informal professional learning was organised amongst teachers themselves through dialogue with colleagues, sharing and exchange of resources with colleagues, networking, or through self-study and self-teaching, reading research journals, books, magazines, exploring websites, teachers and students learning from each other, and joint teaching activities.

Table 16 indicates the frequency of all 79 participants' engagement with four sources of professional learning. These sources included professional readings that participants may have received from their leaders or resourced through the library or other means. Other opportunities for professional learning came through informal dialogues with colleagues and a network of relevant people. Further professional learning opportunities came from exchanging educational technology resources and participating in joint teaching activities.

Participants revealed low daily engagement with professional learning. There was an increased engagement in professional learning when considered over a weekly, monthly or quarterly period. Of significance is the high number of responses showing no involvement with joint teaching activities as a means of professional learning.

Table 16

Frequency of Engagement in Professional Learning Opportunities (2018)

Professional learning	Daily	Weekly	Monthly	Quarterly	Never
1. Professional readings	5.1%	10.1%	20.3%	38.0%	26.5%
2. Informal dialogue	6.3%	39.2%	22.8%	22.8%	8.9%
3. Exchange of EET	1.3%	19.0%	26.6%	38.0%	15.1%
4. Joint teaching activities	1.3%	10.1%	6.3%	16.5%	65.8%

Theme Five: Leadership

An important focus in my research concerned the contribution and involvement of leadership in integrating EET to assist and empower teachers' pedagogy for the students' education. The participants' collective data indicated that five supportive leadership practices might enable the successful integration of EET into pedagogy. These practices are firstly leaders' competent approach to change and second their management of financial resources for the acquisition of EET and professional learning. The third and fourth practices included leadership competencies for clear communication and encouraging collaboration amongst colleagues and amongst the two deaf education centres. The fifth practice was the ability of leadership to engage with the teachers at a grassroots level. In the next section, I discuss leaderships' contribution to integrating EET in teachers' pedagogy and five practices that support this.

Leaders' role in the integration of EET in pedagogy.

Table 17 indicates four ways whereby leaders might contribute to teachers' integration of EET in their pedagogy. 36.7% of the participants were of the view that the

leaders never ensured that teachers worked to strategic goals for the integration of EET. On the other hand, 41.8% of the participants acknowledged leaders' quarterly involvement. Likewise, 39.2% of participants indicated that leaders' contribution to the collaborative development of EET inclusive pedagogy never occurred. However, 48.8% of the participants were of the view that leaders' contribution to the collaborative development of pedagogy took place every quarter.

A reasonably high percentage of participants indicated that leaders never directed them to EET practices that support students' language development, learning progression, and social growth. In contrast, a slightly lower percentage of participants felt they received this support every quarter. Under half of the participants noted the non-application of common standards of evaluation to assess student progress resulting from their use of EET for linguistic development, learning progression and social growth.

Table 17

Contribution of Leaders to the Integration of EET in Pedagogy (2018)

Leaders' contribution	Daily	Weekly	Monthly	Quarterly	Never
1. Ensure teachers work to the strategic goals	0.0%	8.9%	12.7%	41.8%	36.6%
2. Contribute to collaborative technology development	0.0%	5.1%	8.9%	46.8%	39.2%
3. Direct teachers to technology practices to support learning and social growth	0.0%	10.1%	10.1%	39.2%	40.6%
4. Apply common standards of evaluation for assessment of student progress	1.2%	5.1%	10.1%	41.8%	41.8%

Leaderships' involvement in pedagogy that includes EET.

Table 18 displays five opportunities whereby leaders might support teachers' integration of EET in their pedagogy. The responses of all 79 participants demonstrated that leaders' daily responses to the participants' situations regarding EET are low.

Overall, there were no high responses to various leadership engagement opportunities. Further, the results show that participants predominantly have EET-related discussions with their leaders quarterly rather than daily, weekly, or monthly.

A substantial percentage of participants indicated that they never had classroom observations nor in-person meetings with their leaders. Leaders received low ratings in terms of their acknowledgement of the efforts of the participants who integrated EET. Nearly half of the participants felt that their efforts of including EET in their pedagogy went unrecognised. Further, most participants gave leaders a low score on their support to obtain the EET required for pedagogy. While a substantial number of participants felt they received no immediate support to acquire specific equipment and software, almost the same amount of participants felt they received this support quarterly.

Table 18

Frequency of Leaderships' Involvement in Pedagogy that Includes EET (2018)

Leadership involvement	Daily	Weekly	Monthly	Quarterly	Never
1. Discussion	1.3%	10.1%	12.6%	38.0%	38.0%
2. Classroom observation	0.0%	1.3%	10.1%	27.9%	60.7%
3. In-person meetings	1.5%	16.3%	19.0%	29.1%	34.1%
4. Acknowledgement of individual efforts	2.5%	5.1%	17.8%	30.4%	44.2%
5. Support in obtaining dedicated EET	0.0%	7.6%	20.2%	34.2%	38.0%

Change.

All participants observed that change was a constant in the journey from paper-based to digital learning. T3 stated:

You are continually updating yourself, and the kids are constantly updating what they know and the apps they are using because, let's face it, technology evolves. It might be something that works today that might not work in the next five years

because things just quickly change with this fast-changing technology era that we live in. (T13)

All participants emphasised that ongoing change required appropriate professional learning and support from leadership. They frequently spoke about how they introduced changes in EET to their students by weaving new learning into established knowledge, talking the students through adjustment, and accommodating students' differing requirements when facing change. Regarding attitude to change in technologies, most participants alleged that some situations might be quite challenging, such as the recent operating system change made by the two deaf education centres from Google to Microsoft. In this regard, T7 stated:

I think the most important thing is attitude. I think people have to have that open mindset, a growth mindset, and then they aren't going to create barriers within themselves to learning. They will want to continue learning and be lifelong learners, and they will encourage their students to be lifelong learners as well. (T7)

Some participants appeared to be reluctant to make changes, while others were excited because they understood its value. T1 described change as follows:

I think you could very easily get yourself into a real spin about coming up to speed with these new systems and technologies. But I try to focus on the positive things about it, and leadership has obviously made the changes for a reason. I focus on the good things about the change rather than the things we can no longer do because we're not using the old system. (T1)

T7 spoke of the importance of ensuring that changes should be relevant to their particular teaching and learning context:

I think that what's important in terms of digital communication and visual communication changes is that these changes are suitable for our environment of deaf education. We have to be very careful about making sure that we utilise those applications that accommodate our uniqueness. (T7)

Several participants discussed the changes required in using a collaborative teacher-learner approach where they learn from their students to stay informed on some current emerging technology applications. T2 stated, “I found that it [technology applications] was a process of me learning from the children and the children learning from me”. T9 commented on this changed relationship as being one in which “you have to take risks. You have to have a growth mindset, and then you have to be willing to learn”.

Two participants expressed a notably positive attitude to change in EET. T13 stated:

How do you accommodate the change? You embrace the change. How do you accommodate that? Very easy, you just grab it as quickly as you can and then make the situation even better, which is what we as teachers do. (T13)

T14 indicated, “I'm generally very open to changing with technology. I love learning new things. I love being able to have new ways of doing things”.

Budget.

All participants expressed a range of views on leadership's responsibility for the equitable division of financial resources to acquire EET. Budgetary issues included the necessity for leaders to carefully consider and astutely manage limited finances to ensure the fair distribution of Internet access, hardware, software and apps, which support students' learning. T8 stated:

With technology, we can't just buy whatever we want to for teaching. It's really important to review regularly what technology we're actually using and to make sure that we are using what was purchased before. (T8)

T10 noted how important a budget for technologies was, "I guess when it comes down to it, it's the funding that determines what we have". T4 emphasised the need for a dedicated budget for professional learning and suggested that expertise gained from professional learning could be distributed: "Monies need to be set aside for professional learning. There need to be teachers with expertise who can share their knowledge with other teachers, and professional learning communities need to be fostered".

Most participants indicated that the budget used for EET needs to meet students' learning requirements and contribute to their social growth. T6 stated:

I think it's essential to keep in mind when leaders plan the budget to consider what the needs and priorities are that are out there and actually glean this information from talking to those people who are working in the front line. (T6)

Communication.

All participants placed a high value on clear communication lines from leadership when making necessary changes. They discussed the communication role of leadership in the DHH context. Further, all participants also deliberated on how leaders accommodated EET and its challenges for communication. Finally, all participants conversed on leadership requirements for the communication between stakeholders.

Leaders' communication in the DHH context.

All participants commented on the importance of leadership's integration of communication using EET in the DHH context. One participant spoke of personal experiences, as a deaf person, of how technological advancements, through leaders'

efforts, provided communication support and benefits. All participants indicated that clear communication should be a strategic goal in leadership. T11 quantified, “We need a little extra time to make sure that our communication is working right and that we're on the same wavelength. If that works well, it makes all the difference”.

Leaders' accommodation of EET for communication.

All participants thoughtfully considered leadership's role in accommodating potential communication improvements offered by technologies such as Zoom video conferencing, texting, Messenger, Glide, Slack, and Appear. They mentioned leaders' budgetary provision for communication apps such as Facebook, Twitter, Google Docs, and Microsoft Teams to support socialisation and connect people. Other communication technologies collectively identified by the participants as supporting social collaboration and communication included e-mails, scanning of documents, Google Docs and blogging.

Leadership for specific communication challenges relating to EET.

Some participants described specific communication challenges between the two deaf education centres and mainstream schools for leaders to address. T14 perceived leadership as disinterested in communication, “I've never had anyone ask me how I'm using ICT to do anything with my teaching practice, so I'd say there's no communication around it”. T9 described the difficulties with e-mail communication that leaders need to address as follows, “In terms of e-mails, it's hard belonging to two different schools. We have a deaf education account, and we have the school account where I work. So every day, we have to check both accounts”.

T8 was of the view that leadership had specific responsibilities for sharing communication relating to EET:

It would be nice if we were given more information about what's out there and given advice on the good use of technology. It would also be good to know what research has found and made sure that we share it with everybody. (T8)

Leadership in the communication between stakeholders.

Some participants discussed communication challenges between the two deaf education centres, mainstream schools, provisions and families. T9 addressed the need for Wi-Fi access for families so that teachers could share information with them about what was happening in the school. Several participants also discussed communication improvements from the integration of these technologies made by leadership. T10 described how the development of EET had improved communication:

Over the last years, communication through technology is happening more and more. Things have gotten better and better. I think that time has been an element. Because of time, hardware, as well as the software side of it, has improved to the point where we're taking it for granted now that we can have a video conference and multiple conferences over a long distance. (T10)

Similarly, T12 noted that digital communication had become ubiquitous:

Video communication has become very popular and easy to access on the phone. Young people want the answers now, so finding the right channels for instant communication is important for kids today. They do not want to wait a long time for responses. (T12)

Collaboration.

All participants commented on collaboration at an in-house, local and national level. All participants experienced opportunities and barriers in their collaborative

practices. Some participants identified the significance of leadership in planning and creating a culture of collaborative practices. T8 recognised that leadership had a vital role in providing guidance and professional learning on the benefits of collaboration and how local and national communication might occur through purposefully maintained technologies.

Collaboration for various educational purposes.

Data indicated that all participants saw collaborative experiences as positive opportunities to share information, ideas, skills and planning, and as avenues for supporting each other. Some participants identified that EET provided many and varied opportunities to support collaborative activities, both for local contact and nationally between the two deaf education centres.

Technologies to support collaborative teaching practices included communication platforms for national staff meetings, collaboration with mainstream teachers and mainstream students, one-on-one or group collaboration, and learning networks. Regarding communication across the two deaf education centres through national staff meetings, T1 commented, “Certainly the national staff meetings seem to be very collaborative because we’re all working and contributing to that”.

T7 and T8 discussed how EET supported collaboration with remote locations as these technologies allowed teachers to plan creatively with each other across distance and further saved on travel and organisational time. These two participants also discussed how the integration of EET had lessened the isolation they had previously experienced and allowed for more equity and consistency in terms of student learning.

Collaboration among colleagues and students occurred by planning the Keep in Touch Days and Language Days. These are both opportunities for teachers and students across the region to collaborate, meet and share planned learning and social activities on

a given day. Other collaboration occurred through contact with mainstream teachers. T7 discussed collaboration through belonging to a virtual network of teachers:

I access the virtual network and so I can connect online with other educators who are in the same boat as me, and we have discussions in that forum that I am part of. I'm noticing the similarities but also the uniqueness about organisations and education. I know that when I was telling them about things that we do in deaf education, they realise that it is so unique. So it is great learning for me in that I can connect to them. (T7)

Collaboration between the deaf education centres.

At the time of my research, most participants had not made formal contact with their colleagues at the other deaf education centre. As part of the interview, all participants discussed the position of their current personal collaboration with teachers at the other deaf education centre from the one where they worked. Participants were mindful of the coming merger between the two organisations, and their collective view on collaboration resulting from this development ranged from excitement to suspicion. The following three quotes express participants' views on collaboration leading up to the merger:

I haven't had a direct conversation with anybody at the other deaf education centre yet, but I can see how this can be very doable. I just don't know anybody yet down there. (T1)

Collaboration with the other deaf education centre was initially limited. Initially, there was a "them-and-us" attitude. Now we collaborate by developing video edited sign language resources to access the communication. (T13)

Kelston and van Asch can collaborate a lot more and share the resources because we have now got the same platform. We've both got the same communication

system, the same storage of files, and we're communicating a lot more. I can see lots of advantages there. (T8)

Although most participants had not put national levels of collaboration into practice, they saw the merger as a source of increased opportunities to develop and collaborate on shared philosophies, curricula and pedagogy. They also recognised that the merger might bring national collegiality through opportunities to share information and collaborate as teams. All participants were aware that the merger would bring substantial change to their working ways and would require new and collaborative contact and communication going forward. Further, all participants identified that the integration of EET could be pivotal for supporting collaboration across the two deaf education centres. The participants also noted that the integration of EET for collaboration across the two deaf education centres would require strategic planning and management support.

Meeting grassroots requirements.

All participants recognised the challenges leaders face to accommodate the integration of EET into the teachers' pedagogy. However, most participants expressed disquiet about the seemingly limited and timely leadership involvement to support teachers in applying EET in teaching practices. T8 said, "Management really doesn't come down to visit me and discuss the technology or such related information". T12 stated, "It is that relationship between them and us that is important because we are the ones using the technology, but they are the ones deciding which technologies we will use".

Some participants felt that leadership required a deeper connection with what was happening at a grassroots level. This connection would give teachers a greater sense of

enjoyment, direction and confidence about their contribution to the bigger picture of the students' education. T1 stated:

Sometimes I just feel as though those who are making some decisions up in the leadership level don't have a clear enough understanding of what it is that is happening down at the grassroots. (T1)

T14 maintained, "I'd love to see teaching staff on the leadership and budget team. It would be very good seeing the frontline staff represented".

Some participants stated situations where they felt that leadership expected too much from them and was not meeting them at a grassroots level. They believed that technology had increased their workload rather than making things easier. They reported that leadership seemed unaware of the extent to which teachers used their own money to pay for professional learning on a particular topic or to buy the hardware, software or apps they need for teaching. While clarity around cyber safety and safe Internet use by teachers and students would appear as essential leadership considerations, only two participants mentioned this.

The quotes in Table 19 capture the views of participants on leadership practices supporting the EET integration. These views concern clarity on the strategic planning for integrating EET in teaching, opportunities for professional learning, and dedicated time to achieve the effective implementation of EET. Other views include remediating equitable access and inclusion discrepancies and appointing a lead person to support teachers' application of EET. Further notions relate to implementing distributed leadership, leaders' communication/listening/change management skills/positive attitude, leaders recognising and utilising the teachers' skills and available resources, and reviewing the consistent use of EET.

Table 19

Participants' Views on Leaders' Practices to Support the Integration of EET (2018)

Leaders' Practices	Participants' Quotes
Strategic planning to integrate EET in teaching	"Also crucial to leadership is a long-term plan overview covering three to five years and reviewing this yearly" (T10).
Opportunities for professional learning	"If you're going to provide technology in the curriculum, you do need to provide the support that goes with it. That needs to come from leaders and the managers" (T3).
Dedicated time to ensure the effective implementation of EET	"We are told about new apps which are put onto our iPad and pushed out to us, but we're not given the time to sit down with others and collaboratively work through to strengthen, our understandings" (T4).
Remediate discrepancies to ensure equitable access and inclusion	"What would be good is making sure that there's more consistency throughout the centre" (T8). "There's a lot of discrepancy of things on who's got what, which makes situations tricky" (T14).
Appointing a lead person to support teachers' application of EET	"We do need a person who's got those skills whom we can get hold of because sometimes it might only be a three-minute conversation, but it will save me hours of trying to fix what's gone wrong" (T6).
Provide for distributed leadership	"Leadership is not about dictating what people do. Instead, it's about distributing leadership. It's vital to empower people to have opportunities so that others can experience an uptake of leadership, and become leaders in their own right. That then creates your succession plan, and that is an essential thing to have" (T7).
Communication, listening, change management skills and positive attitude	"In leadership, it's about listening to people's understanding and people's frustrations and being able to manage people so that they will then adopt what you are trying to establish. Leadership is about supporting people so that they accept the changes and that they feel satisfied and happy in working with those changes. I think a great attitude to leadership is required and that they promote and share their experiences and truly support e-learning" (T7).
Leaders recognise and utilise teachers' skills and available resources	"I think it's really important for leadership to get to know their staff well and to be strategic in where they put their staff because people are important. Going back to that Māori proverb that people are very important. Without people, the technology would not function as we would envision it to run. So it is essential to be strategic with our human resources" (T9).
Reviewing the consistent use of EET	"It's really important to review regularly what technologies we're actually using and to make sure that we are using what was purchased before. We need educational technology to be an effective tool. But we also need to implement it well so that it's easy to use because as soon as people have frustrations, it all falls apart" (T8).

Summary

I discussed five themes that resulted from the data on teachers' integration of EET to educate students who are DHH. These themes were: (1) pedagogy, (2) use of technology, (3) opportunities and challenges, (4) professional learning, (5) and leadership practices for developing an environment conducive to the integration of EET. Related quotes from the interviews supported these themes. Tables 9 to 19 explain aspects of the five themes through quantitative and qualitative data.

The five themes identified that collectively, the participants utilised EET hardware, software and apps in their pedagogy as opportunities to support their students' learning. Challenges relating to the implementation of EET included the requirement for time to become proficient in the use of EET, equitable access to these technologies, relationships with mainstream and host schools, access to professional support, and identifying possible negative impacts of EET. Not surprisingly, given their disparate contexts, the participants' EET experiences in their teaching practices were diverse. However, these challenges provide opportunities leading to recommendations and proposals for further research, as identified in Chapter Six.

All participants observed that students who are DHH, and who include EET in their learning, benefit from this integration in terms of their language development, learning progression and social growth. Participant feedback indicated that generally, students found the integration of EET to be engaging and interesting. Most participants noted that the students felt motivated by the EET and enjoyed the learning process through these technologies. I will discuss the data results of this chapter as applicable to my research questions and the literature in Chapter Five. Further, I will deliberate on how the TPACK framework may provide a theoretical foundation for building the practice of integrating EET in pedagogy to educate students who are DHH (Koehler et al., 2013).

Chapter Five: Discussion

Ko te manu e kai ana i te miro, nōna te ngahere. Ko te manu e kai ana I te mātauranga nōna te ao: The bird that partakes of the miro berry owns the forest. The bird that partakes of education owns the world. (New Zealand Ministry of Education, 2017b. p. 14)

In this chapter I discuss the themes identified in Chapter Four relating to my research problem and research purposes on how teachers of students who are DHH integrate EET into their pedagogy. This discussion aims to raise awareness of the practice of integrating EET in the pedagogy for students who are DHH and contribute to their education. In this chapter, I address this discussion through the four research questions:

Question One: How are teachers of students who are deaf or hard of hearing in New Zealand integrating emerging educational technologies into their teaching?

Question Two: What are the opportunities and challenges faced by teachers of students who are deaf or hard of hearing, and the support required by them to integrate emerging educational technologies into their pedagogy?

Question Three: What features of the emerging educational technologies do teachers of students who are deaf or hard of hearing perceive as positive and negative to student-centred inquiry outcomes and social growth?

Question Four: What leadership practices do teachers of students who are deaf or hard of hearing perceive as enabling or hindering the

equitable implementation of emerging educational technologies
for student-centred inquiry?

I also discuss the theoretical significance of the TPACK framework (Koehler & Mishra, 2009; Mishra & Koehler, 2006) for these teachers' integration of EET. My discussion refers to the literature review in Chapter Two, themes from the analysed data, and quotes from participants, as identified in Chapter Four. The purpose of this discussion is to inform the limited empirical evidence in the literature about the integration of EET by teachers of students who are DHH with a particular focus on New Zealand teachers. Further, this discussion informs my conclusions, recommendations and proposals for further research in the next chapter.

Overview of the Discussion

I identified the five themes of the results of my data analysis (see Chapter Four) concerning my research problem on how teachers of students who are DHH integrate EET in their pedagogy in Table 20. The relationship between themes and the four research questions form the basis for my discussion.

Table 20

The Connection of Themes to the Discussion of the Research Questions (2018)

	Theme 1: Pedagogy	Theme 2: Engagement with EET	Theme 3: Opportunities and challenges	Theme 4: Professional learning	Theme 5: Leadership
Question One: How are teachers of students who are deaf or hard of hearing in New Zealand integrating emerging educational technologies into their teaching?	•	•	•		
Question Two: What are the opportunities and challenges faced by teachers of students who are deaf or hard of hearing, and the support required by them to integrate emerging educational technologies into their pedagogy?			•	•	•
Question Three: What features of the emerging educational technologies do teachers of students who are deaf or hard of hearing perceive as positive and negative to student-centred inquiry outcomes and social growth?	•	•	•		
Question Four: What leadership practices do teachers of students who are deaf or hard of hearing perceive as enabling or hindering the equitable implementation of emerging educational technologies for student-centred inquiry?					•

The participants' survey and interview data revealed six features and relevant descriptors for integrating EET in their teaching. Table 21 provides an overview of these features and descriptors. I then discuss these six features and their descriptors individually in response to each of the four research question.

Table 21
Features of EET in Teachers' Pedagogy (2018)

Feature	Descriptor
Research Question One	
1. Requires certain conditions	Need for the accommodation of varying views Creating an environment of trust Clarity on the purpose of EET integration
2. Suitable for multiple situations	Problem-solving and addressing abstract concepts Communication/Sharing/Collaboration Innovative and creative approaches to learning Connecting with families, colleagues and stakeholders
Research Question Two	
3. Provides learning opportunities	Engagement of students with learning Clarifies abstract concepts Language development Scaffolded learning Developing social skills and interactions Assessment of learning progression
4. Comes with challenges	Rapid change and lack of time Strategic leadership for the integration of effective implementation of EET Access to professional learning Relationships with host/mainstream schools Cyber safety and other vulnerabilities Practical day-to-day challenges
Research Question Three	
5. Impacts students' learning and teachers' pedagogy	Positive implications Negative implications
Research Question Four	
6. Requires the involvement of specific leadership characteristics and practices to ensure its effectiveness, equitability maintenance and continuity	Strategic planning and navigation through situations of change Relational leadership Collaborative, operational leadership

Research Question One

Research Question One: How are teachers of students who are deaf or hard of hearing in New Zealand integrating emerging educational technologies into their teaching?

Concerning the first research question, the participants of my research, like their colleagues in mainstream schools, integrated EET in their teaching of the New Zealand school curriculum. The curriculum subjects are English, the arts, health and physical education, other languages, mathematics and statistics, science, social science, and technology (New Zealand Ministry of Education, 2007b). A recent addition to the existing technology curriculum prepares students for the digital future (New Zealand Ministry of Education, 2017a, 2018a).

When addressing the first research question, my data revealed that the participants held varying views on integrating EET in their pedagogies. All participants discussed the significance of trust in the process of integrating EET in pedagogy (Benade, 2017; Harris et al., 2013; Noonan & Walker, 2008). Also, most participants referred to the importance of having clarity of purpose on integrating new EET (Cabellon & Brown, 2017; Hadjithoma-Garska, 2011; Kurian & Ramanathan, 2016). Collectively, participants revealed four occurrences where they integrated EET in their teaching. These occurrences are for problem-solving and clarifying abstract concepts; and communication, sharing and collaboration. Occurrences for integrating EET are further for innovative approaches to advance students' language development, learning progression and social growth; and to connect, communicate, share and collaborate with families, colleagues and others to support the students' learning. In the next section, I discuss these features and descriptors related to the first research question.

Varying views.

The results of my first research question showed that all participants held varying views and opinions on integrating EET in their pedagogy. Collectively these attitudes ranged from a sense of frustration to an enthusiastic appreciation of its use. T5 stated:

Educational technologies hasn't affected my teaching much because I still really believe strongly in the use of books, games, toys, working with other kids and in-person conversations. The most important thing is for our kids to be learning to talk to other people, manage themselves in society, and not to be fixed to a screen. (T5)

On the other hand, T1 felt positive about the integration of EET into pedagogy, saying that:

I feel so grateful to have access to educational technology. On the odd occasion when my computer has crashed, I just feel completely lost without it because the computer is just a huge and integral part of my day-to-day work. Without the computer, it would be very difficult to be effective.

T7 explained this variation in views as, "Some teachers are really motivated. They understand that technology is important, and they want to upskill themselves. Other teachers are very reluctant". This participant's observation mirrored the finding of Knesek and Christensen (2016), Petko (2012), and Thota and Negreisos (2015), who concluded that teachers' views on this topic ranged from eager involvement to apprehension, frustration and resistance. Further, individual teachers' levels of knowledge, motivation and experience in EET appeared to influence their attitude towards its integration (Barnes & Kennewell, 2016; Mueller et al., 2008; Sadeck & Cronjé, 2017).

Also, the teachers' actual application of the eight EET referred to in the online survey showed different levels of usage. Participants primarily embraced portable digital devices, broadband for streaming and digital games. At the time of the online survey and interviews, augmented reality, artificial intelligence, virtual reality, and robotics were not technologies that the participants used in their day-to-day teaching practices and most had not applied these. This situation aligns with research scenarios that concluded that teachers do not necessarily use certain technologies to facilitate classroom practices. There may be reasons for this, such as poor Internet connections, the dearth of supporting facilities, lack of supportive leadership, and excessive teaching work (Khamprem & Boonmoh, 2019).

Further research correlating with my data included the studies of Hadjitthoma-Garstka (2011) and Knezek and Christensen (2016). They proposed that teachers' tenacity, attitude, intrinsic motivation, and beliefs about teaching and learning with EET and extrinsic factors are central to this integration. Drent and Meelissen (2008) and Vongkulluksn et al. (2018) affirmed this conclusion, highlighting the importance of teachers' personal beliefs, early adoption and entrepreneurship to integrate technology into pedagogy. Also, Yeung et al. (2012) and Yu (2013) drew attention to the significance of supporting teachers in their application of EET to learn to value its effectiveness and gain confidence in its relevance for classroom application. Similarly, Buabeng-Andoh (2012) concluded that teachers with positive attitudes, motivation and beliefs about EET are more likely to use and adopt these when delivering curricular content. T1 affirmed this conclusion by stating that:

My technology journey as such is that I definitely use technology all the time because it is a matter of having to, and as time goes on, I've felt more and more confident using it. (T1)

Trust.

Several participants reported on the importance of building an environment of trust when integrating EET. T10 said, “You’ve got to build up trust, and build on it within the classroom”. In this regard, Fink (2014) and Noonan and Walker (2008) noted the importance of defining, establishing and maintaining trust within the school when integrating EET. Trust supports an environment of safe and confident application of EET (Wang, 2008). Further, a culture of trust enhances performance and collaborative professionalism (Hargreaves & O’Connor, 2018; Harris et al., 2013). Trust enables teachers and students to integrate contemporary trends in EET, be responsive to each other, and take risks (Wang, 2008). Further, credibility and trust are necessary to leverage the latest technologies into pedagogy (Berk, 2010). To achieve this, leaders need to adopt constructs and models that build on trust to ensure the purposeful continuity of EET in pedagogy (Lankton et al., 2014).

Purpose.

Multiple studies indicated that the purpose of EET in teaching is to support the students’ independent learning, communication skills, social growth, personal intelligence and learning styles (Rajesh, 2015; Reynolds & Chiu, 2015; Schooner et al., 2017). A further purpose is to equip students for thriving in the digital world (Eaton, 2015; Jose, 2016). All participants indicated that the integration of EET to assist learning became meaningful once they had clarity on its purpose and educational benefit.

In this regard, T9, who keenly pursued the integration of new and changing technologies in education, specified that as a teacher, “You have to find a purpose for the use of the technology before you have buy-in”. All participants defined that their purpose for integrating EET was to engage, support, extend, enrich and personalise their students’

skills and acquisition of language, reading, writing and numeracy. T4 said, “I will use educational technologies to enhance and take the learning further”. All participants based their pedagogy on the values of student-centred inquiry (Chegenizadeh et al., 2012; Roberson & Serwatka, 2000). Student-centred inquiry develops students’ skills and attitudes for self-directed lifelong learning (Barber & King, 2016; Manning, 2017; New Zealand National Library, 2019). Concerning student-centred inquiry, T9 said:

Inquiry learning is much more than just getting the content, engaging the students and differentiating the program for them, as the whole point of education is for the students to find meaning in what they are doing. (T9)

Situations for integrating EET in pedagogy.

Once participants gained confidence in using a particular EET, they felt positioned to use it in their teaching. This behaviour aligns with the conclusions of Buabeng-Andoh (2012), Ward and Parr (2009), and Yeung et al. (2012). In Figure 22, I present and then discuss four situations where participants integrated EET in their pedagogies. They incorporated these technologies for problem-solving and explaining abstract concepts; communication, sharing and collaboration; innovative approaches to learning; and connecting with families, colleagues and others.

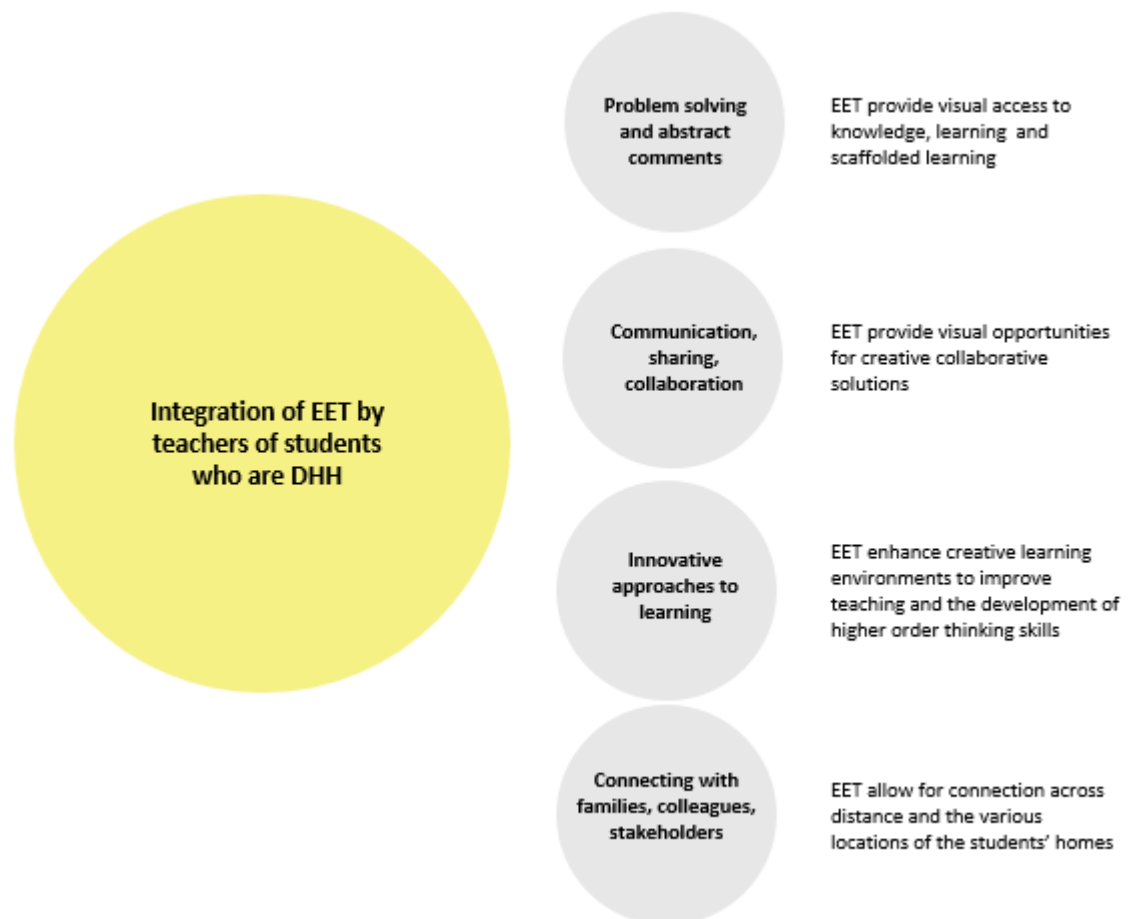


Figure 22. Four situations in which participants integrated EET in their teaching.

Problem-solving and abstract concepts.

Both the conclusions from extant research and the collective participants' data described the significance of integrating EET to develop the students' problem-solving skills and engage their imagination (Kubilinskiene et al., 2017; Papavlasopoulou et al., 2016). The authors of multiple studies and all the participants recognised that these technologies have the potential to support an understanding of abstract concepts as they provided visual access to knowledge (Kubilinskiene et al., 2017; Papavlasopoulou et al., 2016; Rahman et al., 2017) and New Zealand Sign Language (Kuntze et al., 2014; Marschark et al., 2015; Perniss et al., 2014). Like Snodden (2010), several participants affirmed that students' use of video recordings and their development of editing skills produced real-time snapshots and visual records of their work. Further, participants

explained that visual images helped clarify barriers to students' learning, both at school and for lifelong learning. Further, visual options contributed to their communication through media such as stories and blogs (Akdag & Özkan, 2017; Krish et al., 2012; Speranza, 2015). In this regard, T11 concluded, "Honestly, we should not underestimate how well they [EET] are used and how good they are for our learners to have access to and use both at home and at school".

Communication, sharing, and collaboration.

Benade (2017), Bers (2010) and Heath et al. (2015) agree that EET have the potential to support communication, sharing and collaboration in education. Many participants found that motivating reasons to integrate EET in their teaching included the opportunities these technologies provided for communication, sharing, and collaboration. T7 explained it as, "Now it's more about collaborative teaching. It's about creative exploration; it's about children producing for themselves. It's about the child creating the work and learning themselves". All participants also integrated educational technologies to share teachable moments and scaffold learning, beginning with straightforward and repeated activities to consolidate knowledge (Duncan-Howell, 2010; Valentine & Skelton, 2008). T9 identified that as a teacher, "You know exactly which apps or programs work for which student, and you know how to scaffold and use those programs with your students because you know them well".

Innovative approaches to learning.

Most participants believed that the innovative integration of EET enhanced a creative learning environment. This environment, in turn, improved the quality of teaching, learning, problem-solving, and offered opportunities to develop critical (higher-order) thinking skills (Becta ICT Advice, 2005; Capuano et al., 2011). All participants also integrated these technologies for aspects of character and citizenship education,

communication and collaboration competencies, creativity and imaginative approaches to learning and research that also identified this practice (Drent & Meelissen, 2008; Fullan & Langworthy, 2013).

T10 explained that the use of observation skills when integrating EET “raised the standard of what I’m doing at that particular moment in time in teaching. These standards are driven through a critical way of looking at things”. Once participants gained confidence in their use of particular EET, they felt positioned to use them in innovative ways in the learning process. For example, T7 developed confidence through attending a Mindlab course. This participant explained, “The training supported me to think in innovative ways about modern means of educating children, and how to incorporate digital learning and digital collaboration within the wider context of education, rather than just going with the traditional ways”.

Connecting with families, colleagues and stakeholders.

The authors of multiple studies and the participants of my studies observed that the use of EET provided opportunities for connecting and engaging families with their child at school (Heath, Maghrabi, & Carr, 2015; Koehler et al., 2013; Marks, 2018). Luckner and Howell (2002) discussed the importance of the teacher’s interpersonal communication skills to communicate with students’ families, colleagues, and other professionals. Some participants discussed the integrating of EET to connect students across distance to support student-centred and self-directed inquiry. T10 addressed the need for care and sensitivity towards families by:

... bringing technology right down to their level because at home, they might not have a computer or an iPad, or they might not have Wi-Fi access. For those parents who have Wi-Fi access, you can share almost anything with them about what’s happening in the school. T10

Research Question Two

Research Question Two: What are the opportunities and challenges faced by teachers of students who are deaf or hard of hearing, and the support required by them to integrate emerging educational technologies into their pedagogy?

Through the second research question, I investigated the perceived opportunities and challenges all participants experienced when integrating EET into their pedagogy (see Figure 23). Mohammed (2020) concluded that when the practice of integrating technology in pedagogy aligns with good teaching, learning could be better than without the technology. Concerning purposeful integration of EET in pedagogy, T13 observed, “With the introduction of educational technologies, the opportunities and challenges were certainly there”. The use of EET for assessments appeared as an opportunity that some participants applied. However, several participants mentioned that many assessments they utilised were still paper-based.

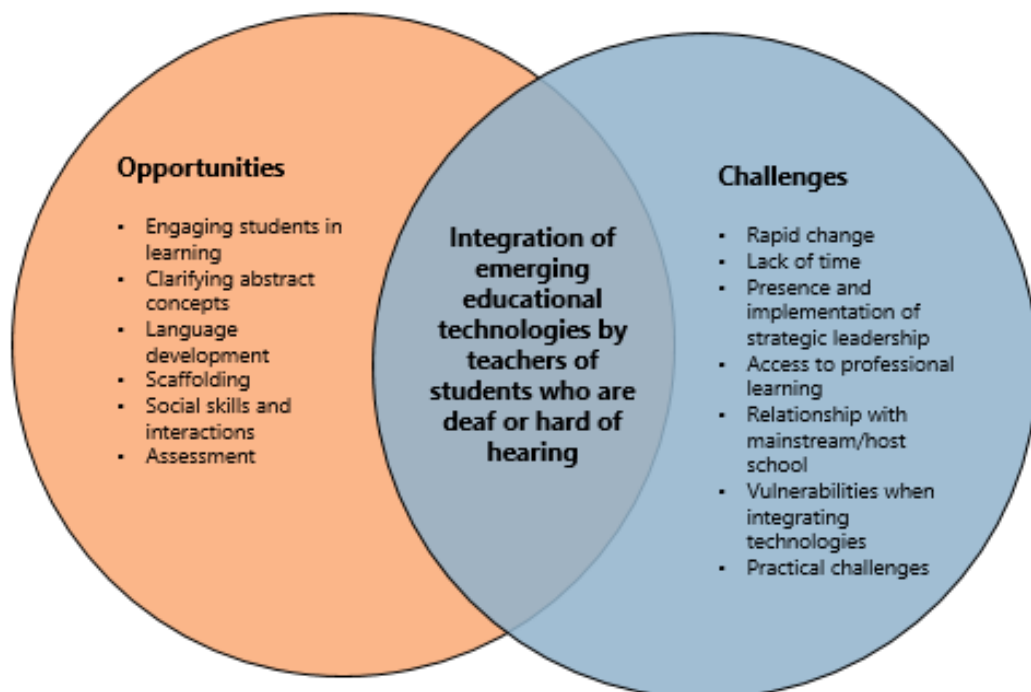


Figure 23. Opportunities and challenges participants balanced when integrating EET in their teaching.

Opportunities.

All participants described the integration of EET in their practice as providing opportunities to engage their students in learning. Further, all participants concurred that EET might support the clarification of abstract concepts through visual means such as pictures, photos and videos. Additionally, all participants explained that EET provided opportunities to support language development. Most participants also identified opportunities that EET contributed to scaffold learning and developing independence in education and social skills. As assessment is integral to teaching, I investigated how participants utilised EET as opportunities for various evaluation methods through dedicated software to record progress and accumulate evidence of practice and learning. I discuss these opportunities for integrating EET in pedagogy in the next section.

Engaging students in learning.

EET create opportunities to engage, mediate and motivate the students' learning (Çubukçu, 2012; Veletsianos, 2016; Zainuddin et al., 2020). Regarding engaging students who are DHH in learning, T9 commented, "It is important that you look at educational technology from an opportunity perspective so that the students can get much more from it, and it's a win-win situation". This participant focussed on the capacity of these technologies as "intrinsically engaging and interactive". T7 commented on the progress resulting from the integration of EET, "Technology these days, its exponential growth, and its advancement has broadened our world as deaf people".

Clarifying abstract concepts.

All participants explained that EET provided visual resources for their teaching to clarify abstract and unfamiliar concepts. This view aligns with the finding of Kubilinskiene et al. (2017), Papavlasopoulou et al. (2016) and Rahman et al. (2017), who highlighted the potential of these technologies to clarify abstract and unfamiliar concepts.

The visual nature of EET appeared to support and inspire equity of learning, writing, spelling, language development, and effective communication. These aspects of learning are particularly crucial in the education of students who are DHH. T10 explained:

The learning introduced through technology is cause and effect. It can explain abstract concepts in a positive way to assist building skills, building understanding, sharing of ideas, and all the things that we want to see happening from a teaching point of view, for our kids' academic progress. (T10)

Further, Fisher et al. (2010) concluded that EET allowed teachers to bring geographically dispersed students visually together through Internet communication platforms. Visual connection, in turn, supports the students' understanding of the abstract concepts of location, distance and collaboration.

Language development.

Lidström and Hemmingsson (2014) identified that EET potentially provided opportunities for language development in the education of students who are DHH in additional ways to their hearing peers. All participants affirmed that these technologies supported rich language development in vocabulary, reading and writing, numeracy skills, social growth and assessment. T9 believed that the integration of EET benefitted students who are DHH in that these accommodate individual language development stages and learning progression.

Scaffolding.

The opportunities provided by EET included their use as resources to scaffold learning for groups or individuals to accommodate their learning styles and personalised learning content (Warren et al., 2008). Research also identified the view that relationships and pedagogy require to go hand-in-hand with teaching and scaffolding for technology to work well (Duncan-Howell, 2010; Valentine & Skelton, 2008). EET thus

provided opportunities to revisit and extend the students' learning without it being repetitive. T9 identified that scaffolding required a thorough knowledge of one's students.

Social skills and interactions.

Other opportunities resulting from integrating EET included their potential to develop social skills and social interactions and provide various situations to teach students independent thinking (Bers, 2010; Cela et al., 2014; Taylor & Packham, 2016). T10 stated that EET assisted in building social skills, constructing understanding, and sharing ideas and information. T4 noted that using technology provided a way to encourage some children to take the next step in their language development, learning progression and social growth, something they might otherwise never have experienced.

Assessment.

Assessments to measure learning activities against known principles and values of teaching and learning are an inseparable component of the ongoing teacher role (Pierson & Borthwick, 2010). Teachers provide oral and written feedback to students regarding their learning progress and conduct statutory formative assessments to meet curriculum and quarterly reporting requirements. Assessments should be non-discriminatory and fair to all students, regardless of cultural and socioeconomic backgrounds (Pizzo & Chilvers, 2016). Assessments include a reflection on the requirements for learning and considerations of working in particular and efficient ways.

All participants discussed EET opportunities for assessments to obtain results, benchmarks, and authoritative checks of student learning progression. T12 noted that "I'm always recording assessments with technology, and this makes the job a lot easier". Several participants remarked that most formal assessments, such as Probes and PM Benchmarks, had paper-based rubrics and did not provide for digital delivery. Some participants recognised that few assessments consider students' social growth. T14

concluded that for assessing students' progress in knowledge, skills, and classroom efforts, "You need a combination of good teaching to go alongside the use of educational technology to improve learning outcomes".

Types of assessment.

All participants discussed the opportunities that EET provided for various types of assessment. These assessments included short answers, multiple-choice questions, Likert scales, matching, true/false statements, brainstorming, self-assessment and self-evaluation. A further assessment method was peer assessment, either with partners, small groups or with the whole class. In this situation, students had the opportunity to view someone's work, evaluate it, and then had the time to think through their responses. Other assessment practices included teachers observing the students to measure the frequency of behaviours, either positive or negative, in reaching learning objectives and outcomes. Day-to-day assessments occurred through questioning, observing, discussing, recapping, feedback, analysis, checking students' understanding and engagement. Some participants said that assessing both intended and unintended learning outcomes offered them an opportunity to switch direction, if necessary, and keep their efforts directed towards the established educational goals.

T3 and T10 discussed the use of the pedagogical strategies of WALT ("We are learning to..." i.e. the learning intention) and WILF ("What I am looking for..." i.e. the success criteria). They used these strategies when including EET as opportunities for a student-friendly way to outline learning objectives, reflect on goals, evaluate and assess the learning (Chróinín & Cosgrave, 2013; Low & Fowler, 2019; Pino-Pasternak et al., 2013). Further, these two participants used WALT and WILF to assess the accuracy of outcomes in terms of these being realistic and at the right level of challenge. They further used these two strategies to determine the learning atmosphere, whether the activities

enabled their students to work towards the outcomes, what required improvement, and establishing how to include new EET and for what purpose.

Assessment with EET.

All participants identified opportunities that specific software applications provided for the assessment of student progress towards meeting the standards of the New Zealand Curriculum, the Education Review Office and the goals of individual education plans (Education Review Office, 2016a, 2019; New Zealand Ministry of Education, 2007b; 2011a). Most participants identified that EET for assessments provided ease of access to conduct pre-assessment, formative and summative assessments (T11) and gave access to instant feedback (T9), which allowed immediate addressing of problems (T10).

Some participants identified that a further assessment opportunity came from EET that facilitated recording students' speech and transcriptions, thus assisting language assessment (T1). EET supported the assessment of the enriched students' research projects (T1) and accommodated photos as part of learning stories (T3). Informal diagnostic assessment, using EET, allowed participants to identify what learning stage their students had reached and what skills they needed next (T4).

Other opportunities for assessments that utilised EET included recording progress of what students set out to accomplish (T7), uploading screenshots into a learning platform (T9), using software with background noise to assess listening skills (T11), and assessing videos of sign language recordings by watching and pausing to reflect (T10). A few participants described the importance of the student management system, KAMAR, end-of-year assessments, and ascertaining the exact number of credits achieved by the students (T6).

Other opportunities for EET to assess students' learning included the repetition of learning and revisiting activities and information. T5 and T14 discussed how EET provided sound files, which supported assessment to improve students' auditory memory. Some participants mentioned that EET could also provide audio verbal/aural language recordings and offer visual samples and records for language assessment of the students' New Zealand Sign Language.

A few participants said that other opportunities included sharing assessment results with parents through EET. Sharing of assessment information using EET might occur through photos, stories, texts and e-mails to encourage parental involvement in their child's individual education plan goals. EET also provided parents with timeframes for their child to accomplish specific tasks and pointed out information regarding exams.

Hardware, software and apps for the assessment.

EET have the potential to provide an unbiased assessment of student learning (Champaigne, 2013; Roblyer & Doering, 2014; Pizzo & Chilvers, 2016). All participants identified opportunities provided by specific hardware equipment – such as video cameras, digital cameras, Smartboards, iPads and laptops – software and apps to assess language development, learning progression and social growth of their students. Appendix E contains a table of all the hardware, software and apps discussed by the participants.

In summary, two participants' views on the opportunities provided by EET capture the general opinion of all participants. These are, "Having access to EET makes life so much easier. It greatly supports effective working practices" (T1) and that the opportunities for teaching with EET favoured the teaching practices of T10:

I've been really lucky to have had those opportunities to pursue my interest in using technology in teaching. I fully appreciate it as an area that is extremely

exciting and which can be built on. I can use my experiences to help other people who are interested in pursuing, not an alternative way of teaching, but one that can be supported by using technologies. (T10)

Challenges.

Despite the identified opportunities of EET to enhance teaching and learning, all participants also identified six barriers to the successful integration of EET in their pedagogy. Challenges raised by all participants concentrated on the rapid developments and changes in EET and the lack of time to engage with these new developments. A further challenge concerned strategic leadership for the integration of EET. All participants discussed challenges relating to access to opportunities for professional learning. Some participants discussed challenges in their relationships with mainstream schools and vulnerabilities resulting from inappropriate use of the EET. Several participants also raised challenges concerning some practical day-to-day challenges when integrating EET in their teaching. All participants concurred that a positive environment that encourages a social context for including these technologies was crucial to its successful integration. In the next section, I discuss these six challenges.

Rapid change and lack of time.

Two primary challenges faced by all the participants when integrating EET in teaching involved keeping up with fast-moving changes in the technologies and the lack of available time to learn about and integrate these into their pedagogy. T9 was of the view that changes in educational technologies might be professionally demanding in terms of teachers' time and well-being "because to learn to switch to something new or different takes time for people to adjust to".

The New Zealand Ministry of Education (2020) notes the importance of everyone involved to consider how their current assumptions and practices related to the possible change. The participants unanimously indicated that they required dedicated self-study time to turn changes brought about by introducing technologies into purposeful and easy-to-implement resources. Further, they noted that a lack of time to understand the successful integration of EET might lead to lower rates of adoption. This view aligned with the conclusions of Aldunate and Nussbaum (2013), who stated that early adopters commit considerable time to incorporate EET into their teaching, regardless of complexity. Conversely, teachers who were not early adopters and committed small amounts of time to integrate EET were less likely to embrace them and be prone to abandoning this process.

Strategic leadership for the integration of EET.

The Australian Council for Educational Research (2013), Tondeur et al. (2008), and Venus et al. (2019) noted the significance of strategic leadership for the meaningful integration of EET in pedagogy. Most participants also affirmed that they would value leadership recognition regarding their time and effort to learn about new technologies for their pedagogy. Other leadership challenges that most participants identified included ensuring the provision and effective use of EET to improve learning outcomes. Some participants noted that the integration of EET as resources and practices in teaching required careful consideration, positive discourses and thoughtful facilitation to connect these to student learning outcomes. These participants specified that leaders' strategic planning needed to consider the objectives, guidelines and strategies for language development, learning progression and social growth concerning technology integration.

The impact of attitude is particularly important when facing the challenges of integrating EET. In this regard, Beatty (2007) recognised that schools could inspire or

fail to encourage and reinforce an attitude that fosters relationships, values and positive actions. Ensuring sufficient technology equipment, software resources, and Internet access created a further challenge for leadership. All participants were of the opinion that strategic leadership, to provide support and adequate professional learning, is essential when introducing centre-wide changes in technologies for the education of students who are DHH. However, T9 identified that professional learning across various teaching locations needs to meet the learning needs, “One size does not fit all, so professional learning needs to be tailored to suit the focus”. All participants gave examples of the need for centre-wide professional learning in certain aspects of EET, such as Zoom video conferencing, KAMAR Microsoft tools, and various apps. Lack of prompt leadership responsiveness to teachers’ grassroots technology requirements and slow responses by technology support staff caused challenges.

Access to professional learning.

All participants experienced professional learning as pivotal for the successful implementation of EET. Much research concludes that professional learning is a crucial determinant to the successful integration of EET in pedagogy (Buabeng-Andoh, 2012; Morris, 2010; Pierson & Borthwick, 2010). Most participants stayed mindful that professional learning on assimilating EET into learning needed to support the Board’s goals as recorded in Table 19 in Chapter 6 (Combined Board of Trustees, 2019).

The experience of many participants who felt that their professional learning primarily relied on their initiative and working with other teachers and students aligns with the finding of Gil-Flores et al. (2017). The latter determined that teacher characteristics and attitudes are more relevant than the availability of technology infrastructures in explaining its use. Also, the findings of Schrum and Levin (2013) affirmed the participants’ views of access to professional learning in EET as requiring

connections to student learning, hands-on technology use, and a variety of learning experiences. Further, T2, T3 and T4 stated how professional support generated a culture of sharing and learning new knowledge and practical ideas from each other and putting these ideas forward so that all might benefit. It, therefore, appears imperative to attend to the challenges identified by the participants and researchers. The challenges are individually identified below to draw attention to each.

- T2 described the challenge of meeting the requirements for access to professional learning that is “ongoing and targeted because things move and change so fast, and teachers want and need to keep up with the new developments” (Ertmer, Ottenbreit-Leftwich, 2010; Inan & Lowther, 2010a; Mishra & Koehler, 2009b);
- Most participants saw the shortage of access to opportunities for professional learning about EET associated with the education of students who are DHH as a specific area requiring attention (Beal-Alvarez & Cannon, 2014; New Zealand Ministry of Education, 2015a);
- Some participants discussed the challenges of providing professional learning that identified the skill-set of teachers, utilised, and developed these skills (Inan & Lowther, 2010a; Mueller et al., 2008; Webster-Wright, 2009);
- All participants noted the challenge of providing professional learning that met curriculum goals and other requirements for the successful education of students who are DHH and develop expertise by accommodating the different learning styles of students (Beal-Alvarez & Cannon, 2014 & New Zealand Ministry of Education, 2015a);

- All participants expressed the challenge of accessing professional learning for both social connections and technical skills (Chang et al., 2008; Hsu, Hung, & Ching, 2013);
- Some participants drew attention to the challenge of meeting their requirements for professional learning through mentoring and learning support (Akaslan & Kull, 2017; Kazu, 2011; Schachter, 2010);
- Most participants mentioned the challenges of having a budget to obtain technologies, software and attending relevant professional learning events (Eacott, 2011b; Davies, 2010; Hirsh-Pasek et al., 2015);
- Many participants discussed the challenges of finding out about available technologies and accessing the professional learning required for effective integration of these technologies (Darling-Hammond, 2017; Donohoo and Velasco, 2016);
- Most participants discussed the challenges of professional learning required for specific curriculum applications, upskilling in new roles and functions, and active participation by the teachers (Education Review Office, 2016c, 2020; New Zealand Ministry of Education, 2007b).

Relationship with the mainstream/host school.

Some participants stated that they sometimes faced barriers in their relationship with the mainstream or host school where they worked. These challenges arose from the mainstream school restricting access to the Internet, providing little flexibility around firewall security measures, schools using different technology platforms to the one familiar to the participant and challenging the participant's access to technical support for their students. Most participants identified other challenges, such as not being given access to mainstream professional learning; and mainstream teachers not making time to

integrate teaching activities with EET, as recommended by the resource teacher of the deaf (De Smet et al., 2016).

Cybersafety and other vulnerabilities when integrating EET.

One persuasive argument for the integration of EET in the education of students who are DHH is that it opens up communication opportunities for these students. However, the converse is that these students may be potentially vulnerable to misapplication of these technologies. Another challenge some participants faced included the potentially addictive use of emerging technologies (Mohammed, 2020). T14 noted:

Emerging educational technologies need to be engaging and have focus, not simply be entertaining. Handwriting skills must not become neglected as the technology-rich world is here to stay, and it is up to us how we use it. (T14)

Increased use of EET gives rise to new ethical dilemmas (Buchanan, 2019; Lommen, 2016). Collectively participants conveyed specific difficulties. These complications included concerns that some students did not use EET at home due to economic restrictions. This situation might cause them to fall behind and increase the socio-economic digital divide between those who access technology and the Internet and those who do not. Such students required multi-layered support for their pastoral needs, interpersonal skills, and social growth to ensure equity in education.

Other challenges included students' safe online conduct for formal and informal learning and socialisation. These situations required the provision of net safety and protection against cyberbullying (McFarlane & Mina, 2018; Slonje et al., 2013). Further net safety requirements included placing restrictions on access to inappropriate websites, managing personal online identity information, and dealing with distractions and screen addiction.

Practical challenges.

The participants reported practical challenges when integrating EET in their teaching. Some participants stated that the hardware they transported between schools was cumbersome to carry and set up. More than half of the participants expressed frustration at using personal finances to purchase technologies and software for their teaching. One participant discussed having to deal with the situation of technologies that go missing. Other participants commented on receiving excessive amounts of e-mails originating from the two deaf education centres and host schools. A unique challenge regarding sign language is that it is continually evolving and varies across population groups. Learning and staying fluent in signed vocabulary relating to current technologies becomes challenging. Some participants raised the challenge of losing information when receiving newly leased equipment to replace their old equipment. I now discuss the third research question, where the emphasis shifts from the teachers' practice of integrating EET in teaching to this practice concerning the students they teach.

Research Question Three

Research Question Three: What features of the emerging educational technologies do teachers of students who are deaf or hard of hearing perceive as positive and negative to student-centred inquiry outcomes and social growth?

In exploring the third research question, it became apparent that “relationships, pedagogy and knowing your learner well” (T9) is fundamental to the process of integrating these technologies in learning for students who have varying degrees of hearing loss and levels of language competency. In the next section, I discuss some positive and negative implications, identified in the literature and the findings recorded in Chapter Four, of integrating EET in student learning and teaching. I illustrated these implications in Figure 24.

Positive implications of EET on student learning and teachers' pedagogy.

Much research supports the positive implications of integrating EET for student-centred inquiry in mainstream education (Davies, 2010; Fu, 2013). Ford and Kent (2013), Genlott and Grönlund (2016), and Snoddon (2010) also identified positive influences on the student-centred inquiry of students who are DHH. T14 said, "I very much believe in letting students play as much with their technology devices and apps as teaching them around it too". T7 stated:

The technologies are fantastic because it really fascinates them and really draws them into learning. The fact that they use sign language is not a barrier anymore. We can see with the exponential growth in technology and its advancements that it has just broadened and widened up the world for deaf or hard of hearing learners. So all of these applications are a part of that broadening to accommodate the uniqueness of education for students who are deaf or hard of hearing. (T7)

Further positive implications of integrating EET to support, mediate and motivate student-centred inquiry are similar to those identified in Research Question One. These technologies provide personalised visual access to knowledge and assist with language development, learning progression and social growth (Kuntze et al., 2014; Stevenson et al., 2015). Such technologies can scaffold learning and extend, enrich and engage students in building their knowledge, skills, abilities, educational achievement and social growth (New Zealand Ministry of Education, 2020). Further, T8 noted that technology might positively include and support students with muscular issues, who might not otherwise comfortably hold a pen or pencil to write.

Additional positive implications of EET for student-centred inquiry are their potential to make interconnections across the curriculum, provide opportunities to learn from peers and connect home with school. In these instances, EET have the potential to

change, improve and support student-centred inquiry (Australian Council for Educational Research, 2013; Bingimlas, 2009; New Zealand Ministry of Education, 2007b). Also, EET provide effective tools for assessing students' language development, learning progression and social growth. Further, EET combined with sound pedagogy and theoretically grounded use of technology might boost and energise student-centred inquiry experiences, increase confidence, encourage creativity and productivity, and allow students to achieve in previously unavailable ways (Champaigne, 2013; Mishra & Koehler, 2006; Roblyer & Doering, 2014).

Negative implications of EET on student learning and teachers' pedagogy.

Despite the positive impact of EET on teaching practices, there is a need for research on underlying negative implications. Prieto et al. (2011) cautioned that an increased presence of multiple EET in the classroom does not guarantee an improvement in students' learning experiences. Concerning this, T8 stated, "Teachers need to consider carefully the effective orchestration of integrating technologies to overcome delayed language skills, and support learning and social development". Further, the European Commission (2017) recognised that while there is worldwide awareness of the many opportunities arising from EET, today's most significant risk is a society ill-prepared for the digital future of an interconnected and interrelated world. In this regard, Zhao (2015) identified the necessity to engage students in learning opportunities in the global community and reach beyond the classroom and the school walls.

T12 described a situation where EET negatively affected communication, for example, when students did not communicate with each other. Instead, screen time had become addictive and a substitute for in-person interaction, communication and teaching. T12 found that removing the iPads from students allowed them to talk more and

encouraged them from passivity to active engagement in their learning. Participants discussed strategies they applied to prevent addictive screen-time behaviours. These included unstructured playtimes, leading by example, scaffolding screen-time, modelling encouraging behaviours, reading to students and actively engaging them.

Another negative implication leading to inefficient use may occur when students do not have clear expectations on the use or objectives of EET (Mohammed, 2020). A further negative implication is inequitable access to EET for students. T14 put this as follows, “There’s a lot of discrepancy on who’s got what across the different hubs and provisions, which makes situations really tricky”. Both T4 and T14 believed that they had received better professional learning opportunities regarding EET for their pedagogy while they taught in mainstream schools and before they became teachers of students who are DHH. T4 described this as “I’ve had a lot of opportunities as a mainstream teacher. Most of my technology learning has come from my mainstream life”.

Overview of participants’ responses to the third research question.

Figure 24 provides an overview of the data findings of both research question two (what are the opportunities and challenges faced by teachers of students who are deaf or hard of hearing, and the support required by them to integrate emerging educational technologies into their pedagogy?) and research question three (what features of the emerging educational technologies do teachers of students who are deaf or hard of hearing perceive as positive and negative to student-centred inquiry outcomes and social growth?). These two questions investigated and identified the positive and negative attributes for student learning and teachers’ practice when integrating EET in pedagogy for the education of students who are DHH.

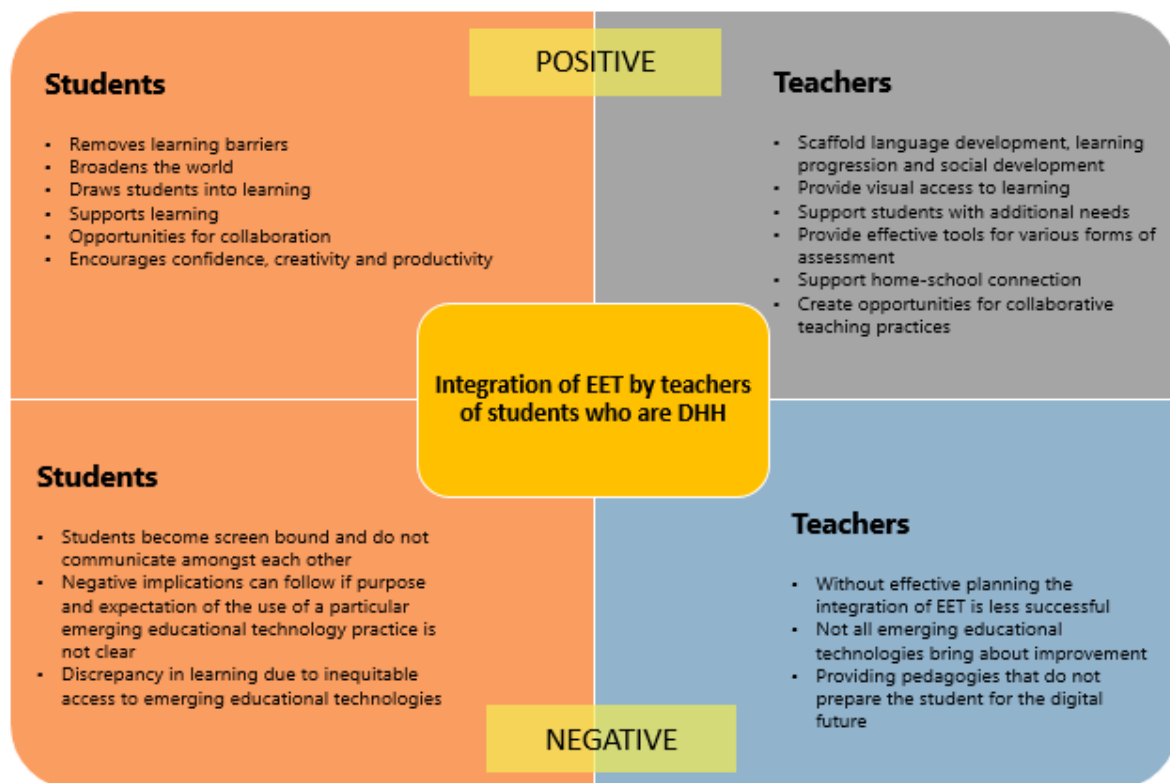


Figure 24. Participants' responses to the positive and negative implications of EET for pedagogy and students' learning.

Research Question Four

Research Question Four: What leadership practices do teachers of students who are deaf or hard of hearing perceive as enabling or hindering the equitable implementation of emerging educational technologies for student-centred inquiry?

My fourth question discussed the participants' perceptions of leadership practices that enable or hinder the equitable integration of EET to advance the students' language development, learning progression and social growth. The key theme of my thesis concerned the use of EET to empower people's education. Concerning empowerment, educational leadership can have a pivotal role in enabling teachers to integrate EET into their teaching practices. All participants recognised the importance of leaders being intentional about including EET for pedagogy. Intentional leadership requires school leaders to develop capacities and capabilities to advance and assess their practices and

deliver transformational results (Imig & Fischetti, 2016; New Zealand Education Council, 2018a, 2018b).

Several participants believed that leadership contributed to the effectiveness of a social and organisational environment that integrates EET. T9 described this as:

Leadership should focus on good teaching that goes hand in hand with technology; otherwise, technology will just be seen as this shiny new toy, and it will lose its significance and value over time. When technology has a purpose, teachers will continue to use it and will continue to improve on it. (T9)

Some participants identified three leadership practices, which they believed supported the integration of EET in their pedagogy. Figure 25 illustrates these leadership practices. These are firstly the requirement for strategic planning and navigation through situations of change. The second requirement is for relational leadership achieved through effective communication and operational leadership attained through collaboration. This finding aligns with the view of Robinson et al. (2008) on leadership practices, which support the integration of EET in pedagogy. The third requirement is for collaborative leadership. In the next section I discuss these three identified leadership practices.



Figure 25. Essential leadership practices participants identified that enabled the equitable integration of EET in teaching.

Strategic planning and navigation through situations of change.

Three aspects of strategic planning and navigation through situations of change became apparent from research findings and my data (see Figure 25). First, leaders implement a strategic plan which requires clear navigation through the circumstances of the change. It implicates long-term and ongoing responsiveness to needs. Also, leadership is relational as it involves consideration of emotional and professional support during times of shifts and reframing of the core activities of school practices.

Strategic planning.

Multiple studies affirmed that leadership during periods of change required a strategic plan known to all (Australian Council for Educational Research, 2013; Tondeur et al., 2008). The strategic navigation of the plan needs to be transparent, long-term and ongoing, and responsive to requirements (New Zealand Ministry of Education, 2020).

Most participants stated that they became familiar with the annual strategic plans to integrate EET through meetings and the Board Charter (Combined Board of Trustees, 2019). T9 explained this requirement as “It's going back to knowing what the program is about and what the purpose is. The purpose behind every educational technology and every program that we are using needs to be clear”. T6 explains this need for clarity as:

I think leadership or management, as I see it, need to prioritise what their main strategic goals are across the board and make sure that those things are implemented well. So their planning and their coordination of staff meetings and organisational expertise and backup has to be well programmed to be successful.
(T6)

Shifts and reframing of school practices.

New Zealand Ministry of Education (2020) and Parlakkic (2013) identified that the effective and sustained integration of EET in teaching required fundamental shifts and reframing of the core activities of schools. It is clear that a philosophy underpinning the integration of EET, and visualised through a framework, is critical for the usefulness of such a practice. An adopted framework guides and influences every aspect of the teachers' pedagogy and the leaders' roles. Associated shifts and reframing of leadership practices when integrating EET include implementing new perspectives on pedagogy, the immersion of the whole school in planning, and teachers' ongoing professional learning. Such strategic leadership practices require good communication, mainly when dealing with transition and change (Tondeur et al., 2009; Venus et al., 2019).

My data revealed a gap in most participants' practice of basing any changes in pedagogy on an adopted EET framework. Only two participants referred to the application of a framework. T4 explained, “So, for example, using the universal design for learning framework, I blend it into the teaching and learning program”. The other

participant discussed the disappointment of not implementing a framework for the integration of EET in pedagogy. Of this, T10 said, “We didn’t get a chance to consolidate the model and the way that we work. That was disappointing. We were just building it up, and then it stopped”.

Relational leadership.

Two criteria of relational leadership that participants identified concerned the practices of effective communication and professional and emotional support.

Effective communication.

Many participants identified the attributes of relational leadership related primarily to effective communication. T7 explained this as “I think communication is really important. It's a strategic goal that people have an understanding of one another. It's a two-way street”. Similarly, T13 viewed relational communication, in the classroom context, as coming about primarily through talking.

From multiple participants’ perspectives, good communication concentrated on articulating a shared vision, developing relational trust with staff, and referring to various sources of information to solve complex problems. Further factors of good communication included maintenance of a focus on the core business of teaching and learning; managing people; developing self and others; engaging and working with the community; cultivating leadership in others; and responsiveness to external demands (Australian Institute for Teaching and School Leadership, 2016; Holmes et al., 2013; Lankton et al., 2014).

Hallinger and Heck (2010) recognised that relational leadership also included collaboration and interconnection. Bendikson (2015), Goleman (2000), and Rutledge and Cannata (2016) identified that communication required truly listening, giving direct

feedback, not being too busy to see staff, following through, not taking people for granted and performing actions consistent with their claims. Practices that support relational leadership include participation in networks and partnerships and taking a collective and distributive approach (Doe et al., 2015; Hauge & Norenes, 2015).

Professional and emotional support.

Strategic leadership requires balancing the organisation's requirements with the needs of the people and staying motivated (Barrett & Breyer, 2014). Research findings reveal that progression by leadership towards improvement, innovation and change requires emotional and social intelligence competencies (Robinson et al., 2008; Ross & Gray, 2006; Williams, 2008). Notably, Lee and Yin (2011) believe that teachers' emotions during organisational change require consideration. Leaders, therefore, guide and assess the various phases of staff members forming, storming, norming, and performing through change (Aitken, 2009; Wilson, 2010). Many participants echoed this need. T7 acknowledged both the need for clarity and the psychological impact of change:

So it's about supporting people so that they accept the changes and that they feel satisfied and happy in working with those changes. You really have to keep in mind the strategic goal and inform people why we are doing this, what our strategic goal is, what's next and feed information and updates on to people. (T7)

Strategic leadership also includes a clearly understood vision of learning success for all students (Murphy & Torre, 2015), pathways for improved instruction and professional learning implementation (Heifetz & Linsky, 2002; Leithwood et al., 2004; Leithwood et al., 2010). Strategic leadership further considers environmental adaptation as and when needed and leadership involvement at ministerial levels. Although leaders appeared to recognise their pivotal role in the professional learning process, financial restrictions and time constraints caused barriers to their roles as instructional leaders

levels (Seely Brown, 2016). Regarding professional learning, T3 highlighted the need for effective leadership in providing opportunities for appropriate professional learning support, “I guess if you're going to provide technology in the curriculum, you do need to provide the support that goes with it. That needs to come from leaders and the managers”.

Collaborative leadership.

Most participants mentioned a third leadership practice for the effective implementation of EET, namely, collaborative leadership. Such leadership objectives in the education of students who are DHH requires alignment of collaboration amongst staff students, parents and the stakeholders of multiple service provisions within the organisation. I commence this section with a background to collaborative leadership practices and then address three collaborative leadership requirements that participants discussed. These are equitable access to EET, the provision of dedicated professional learning time, and recognition of the value of collaborative learning.

Background to collaborative leadership.

The literature and participants' opinions aligned regarding the significant role of collaborative leadership to support the integration of EET in teachers' pedagogy (Mishra, Hendriksen, Bolz, & Richardson, 2016; Ottestad, 2013; Peia & Piaw, 2018).

Collaborative practices aim towards equitable access, professional learning, distributed leadership and collaborative learning communities (Harris et al., 2007; Harris, 2010; Petersen, 2014). Such leadership could support an innovative and communal educational culture to create, promote and align a positive and open climate of trust (Aitken, 2009; Clarke & Wildy, 2010; Louis et al., 2010).

All participants viewed collaborative leadership as providing direction when making evidence-based decisions from observations, data, and collective monitoring of student achievement. Collaborative leadership involves formal and informal networks of expertise with leaders and their teams, which function predominantly in the lateral rather than the vertical leadership dimensions (Harris, 2010; Sharratt and Planche, 2018; Supovitz and Tognatta, 2013). A shared understanding of vision, ideas, diverse perspectives, innovations, empathy and support of the abilities of others characterises lateral leadership. Further lateral leaders are flexible and open to change, approachable regarding the reality of situations, perceptions, and the implementation of vision (Koçak, 2019).

A few participants indicated that collaborative leadership provided measures to ensure the systems and audits for the succession and sustainability of EET. They noted that distributed collaborative leadership gave a sense of purpose and facilitated equitable access to EET integration. Their views reflected research on distributed leadership, particularly relating to delegation opportunities for teachers to participate in leadership (Firestone & Martinez, 2007; Leithwood & Mascal, 2008; Sharratt & Fulan, 2013). T7 said of distributed leadership:

It's about empowering people. It's really important to empower people to have opportunities to delegate and give projects so that others can experience an uptake of leadership as well and become leaders in their own right. That then creates your succession plan, and that is a really important thing to have. I also think that it [distributed leadership] is of importance for students as well as it gives them leadership opportunities so that they can feel confident in what leadership means. You get role models that they can look up to that they can emulate what they are saying. T7

One participant stated that collaborative leadership recognised people's expertise and skills and placed teachers in the best position for success in teaching. T7 expanded on this view:

Utilising people's skills is important as well. Leadership requires looking at staff and their skills and pulling in resources in terms of staffing. I think leaders should be really open to having those open discussions that make sure that everyone within the team is participating into what you're discussing and valuing other people's skillsets as well, and pulling them all together. (T7)

Equitable access.

The role of the school leader has become broader and more complex due to digitalisation. Leaders consequently need to consider the equitable distribution of EET concerning time, resources, professional learning and support of teachers and students (Lindquist & Pettersson, 2019). Further, leaders appear to be pivotal in facilitating the equitable provision of EET to facilitate a positive effect on learning through all levels of schooling (Wu, Yu, & Hu, 2019).

T14 identified that “The allocation of resources appears inconsistent across the different hubs and provisions across the schools. The devices management should be strategically looked at again”. Not surprisingly, given the participants' professional commitment to the field of education for students who are DHH, they held strong views about the requirement for equity of access to EET. T7 believed that “Equitable access for all teachers and students to educational technology is a real big challenge. Obviously, equal access for all students throughout Aotearoa is essential”. T8 described the current situation as follows, “At the moment I see a lot of variety. There's not a lot of inconsistency. I see some amazing things happening, and in another place, I see that they need to polish up”.

Dedicated professional learning time.

Teachers use the Internet to connect with professional learning networks of their discipline areas, share ideas, expand their learning opportunities, and develop their curriculum materials before implementing them in their teaching (Prestridge, Tondeur, & Ottenbreit-Leftwich, 2019). Barton and Dexter (2020) argue that leaders are responsible for fostering circumstances favouring the teachers' effective integration of EET. Teachers require time to participate in an all-inclusive system of formal, informal and independent professional learning about EET integration.

All participants concurred that collaborative leadership should recognise the importance of professional learning and time allocation to understand and implement new knowledge. T4 described the situation of no time provision for understanding and adopting new learning on EET:

We are told about new apps, but we're not given the time to sit down with others and collaboratively work through and play with the technology to strengthen our understanding and learn off each other, ask questions on how to use it and actually experience it for ourselves so that I can then take it to the child, and I have a place to start. T4

In such instances, the teacher is ill-equipped to reach the potential capacity of new technologies, and students do not receive the best learning opportunities from the newly introduced technologies. T6 explained it as:

We need technology to be an effective tool. But we also need to implement it well so that it's easy to use because as soon as people have frustrations, it all falls down. T6

Some participants suggested ways in which such collaborative leadership might provide for professional learning. T8 said:

It would be good to have that one lead person who is given a chance to do the research and who can then give us the information and training consistently so that everyone's on the same page. T8

Additionally, all participants viewed collaborative leadership as building people's knowledge and skills within a technology learning community. T9 identified this central importance of people within the community, stating that:

So just being strategic about where you put people because people are very important. Going back to that Māori proverb, 'People, people, people are very important - He Tangata, He Tangata, He Tangata'. Without people, the technology would not function as best as we would envision it to run, so it is important to be strategic with our human resources.

Collaborative learning.

Collaborative learning provides opportunities to extend and deepen learning experiences and test out new ideas by sharing them with a supportive group and receiving critical feedback (Hallinger & Heck, 2010; Le et al., 2018; Murray, 2015). Leadership that encourages the use of EET, virtual learning and environments of collaborative practices to achieve group goals enhances the advancement of continuous integration of ideas and interdependency amongst the students, staff, parents and stakeholders (Kahai, Jestire, & Huang, 2013). Further, clear representation and understanding of EET-supported collaborative learning are necessary to ensure improved learning experiences (Laurillard, 2009).

An integrated cycle to support the process of collaborative learning and communication between leaders and teachers and teachers and students provide collective benefits for all, including those who live in geographically dispersed or remote areas. This cycle requires collaborative planning for the selected focus of interest and

planning for learning. The cycle further requires observing, developing, exploring, discovering, organising and integrating the learning identified in the selected focus. It also involves evaluating the learning; and critical reflection and possible modification of the learning cycle to ensure the continuity or conclusion of the inquiry (Zhang, Zhang, Sun, Lytras, & Ordonez de Pablos. 2017; Zuber-Skerrit, 2015, 2018).

Further investigation of research and data on collaborative learning provided the following insights:

Leaders, teachers and students build participatory practices through collaborative learning to increase knowledge about the curriculum, implement, evaluate and review the learning. The primary reason for strengthening collaboration is social engagement through networking with others. Social engagement creates opportunities for deep understandings of the teaching and learning processes. Collaboration, in turn, brings about improvement, acceleration, enrichment and higher-order thinking skills in the acquisition of knowledge (Caica, 2011; New Zealand Ministry of Education, 2007b, 2019b).

All participants' views on collaborative learning align with Caica (2011), who recognised the benefit of both teachers and students learning together as a community. Collaborative learning activities present behaviours that show interest, motivation and enjoyment of a task (Kinsella-Meier & Gala, 2016). For collaboration to succeed, teachers draw on teamwork and team-building elements to provide an effective foundation for learning (Laurillard, 2009; Morel, 2014; Vandenhouten et al., 2014). Collectively participants noted that collaboration required collegiality, interdependence, time, patience, tolerance and sound planning. All participants further said that collaborative learning also required the implementation of skills to deal with the complexities of changing circumstances, which are so intrinsic to teaching.

Most participants said that collaboration provided common understandings, opportunities to reflect on ways to improve practices and transfer knowledge and skills, as all participating in the collaborative activity are inquirers and co-learners. Collectively, participants recognised qualities about collaborative and communal participation as being flexible, fluid, dynamic, responsive, and open-minded. Further identified conditions included preparedness to learn from mistakes and accept these as part of the collaborative learning process and recognising variables that can affect student learning, such as student, classroom, teacher and school variables.

Collaboration for learning involved scaffolding, sharing goals, exchanging ideas, negotiating and incorporating different members' perspectives, talents, and learning styles. An intangible element that is integral to the success of learning communities is a passion for understanding the teaching and learning context. This passion may present itself in the desire to help students enrich their curriculum experience and develop content knowledge. Personal and professional passion involves the willingness to experiment with teaching strategies and techniques and advocating for social justice (Boschman, McKenney, & Voogt, 2015).

For co-taught online classes, the few participants who had implemented this recognised the cycle of interrelated collaborative stages to negotiate, organise, conceptualise and guide the use of time. During this cycle, participants at both locations worked compatibly towards defining the lesson's content and then equitably shared and taught the workload. Collaborative learning also required access to relevant knowledge, decisions on the lesson methodology and raising appropriate questions for answering. All participants also valued collaborative learning gained by gathering the lesson's results, evaluating the credibility and accuracy of the teaching, and then reflecting on these results; and finally acting on these findings, and defining the next stage together.

The Significance of an EET Framework

In this second section of Chapter Five, I discuss the results of my fourth research question concerning a theoretical framework for leaders and their staff to adopt when integrating EET in the education of students who are DHH. I consider what leadership practices teachers of students who are deaf or hard of hearing perceive as enabling or hindering the equitable implementation of EET for student-centred inquiry.

An EET framework provides a conceptual perspective from which to use and assess technologies in learning to promote best practice and effective pedagogy since both are at the very core of effective technology integration (Baran, Chuang, & Thompson, 2011; Ertmer & Ottenbreit-Leftwich, 2012; Mishra & Koehler, 2006). Further, as identified in the data of Chapter Four, technology alone cannot improve teaching and learning. Instead, the technology design must support learning goals and not the other way around (Ertmer & Ottenbreit-Leftwich, 2012; Ng, 2015).

As such, my research considered the values, similarities and variants of different theoretical models and then focussed on the Technological Pedagogical Content Knowledge (TPACK) framework (Koehler & Mishra, 2009). Ample research findings indicated that the TPACK paradigm supports the adoption of EET by teachers (Heitink et al., 2017; R  th & Kasper, 2017; Schmidt et al., 2009). Further, the visual construction and justification of the construct of this framework appear to suit the context of the education of students who are DHH (Baran & Uygun, 2016; Koh, Chai, & Tsai, 2013; Niess, 2011).

Integration of the TPACK domains.

Resources, techniques and the application of technology support students to communicate, be mobile, explore, think, read, write, research, invent, and develop problem-solving and analytical skills. The integration of technology further prepares

students to experience the world and be creative, flexible, and entrepreneurial (Australian Council for Educational Research, 2013; Kalaš et al., 2012; New Zealand Ministry of Education, 2007b). Integrating the contextual and technological content knowledge of the TPACK framework (see Figure 26) assists in creating supportive learning environments (Koehler & Mishra, 2009; Mishra, 2018; Mishra & Koehler, 2006).

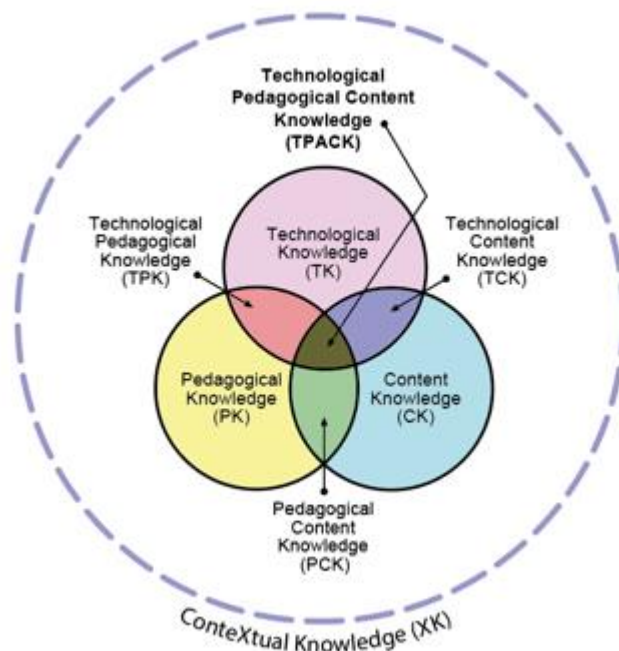


Figure 26. The TPACK framework. © Punya Mishra, 2018. Reproduced with permission.

When integrating the three TPACK domains (technological, pedagogical and content knowledge), its four intersecting domains (TPK, PCK, TCK and TPACK) and contextual knowledge (XK) in teaching, effective instructional methods rather than the instructional media cause the learning (Johnson et al., 2017; New Zealand Ministry of Education, 2018a). All participants reached the same conclusion that pedagogy should be front of mind when implementing EET. T9 stated this as:

It's pedagogy that drives technology. It is good teaching that drives our technology. As teacher, you will know how to make use of technology that will work for your learners. It's not the other way around. You can have the most amazing apps on the globe, and you can have the most awesome software, but if you don't know how to use them in a classroom situation, your teaching can't function. (T9)

Within the context of the TPACK framework, effective pedagogy integrates the acquisition of content knowledge and technological skills required for ongoing student-centred inquiry (Koehler & Mishra, 2009; Mishra & Koehler, 2006). Further, pedagogy within the TPACK framework context makes teaching and learning an engaging and active process connected to real life. The framework balances traditional and contemporary approaches to guide the pedagogy (Greenlaw, 2015).

The domains of the TPACK framework recognise opportunities to learn through participation, peer interaction, self-paced learning, networking, and collaborating with others (Koehler et al., 2013). These learning opportunities arise from, for example, the integration of shared documents, blogging, brainstorming and presentations; active learning through worksheets and apps; and authentic connection with the content and experiences of experts around the world. Relationships enable teachers and students to enter and explore new learning environments, participate in peer instruction, and overcome the barriers of distance and time (Berge, 2013; New Zealand Ministry of Education, 2007b).

Requisites for an emerging educational technologies framework.

A requisite of a framework that integrates EET in teaching embraces a vision and goals that contribute to the students' language development, learning progression and social growth. These vision and goals intend to achieve higher-order thinking, inquiry-

based and critical learning, problem-solving, communication, and networking. The vision and goals are also directed at pedagogy that recognises and benefits leadership, organisational management and the teachers' technical skills, personal experiences and beliefs in EET (Bull, 2009; Kalaš et al., 2012; Newhouse, 2014). Further, an EET framework needs to align with the Ministry of Education's educational requirements. Therefore it requires considering the role of leadership concerning educational policies, planning, language and learning content, equitable access to technologies and financing of fixed and recurrent costs for sustainable technology infrastructures. Although participants did not thoroughly discuss leadership's vision and goals for integrating EET in education or aligning with the Ministry of Education requirements, I considered these because of their relevance for further research.

Vision and goals of integrating technologies.

Taylor (as cited in Bull, 2009) suggested that the importance of a framework for the vision of integrating technologies in the learning process rests on seeing this integration as being in one of three modes: the tutor (teacher), the tool (technology) and the tutee (student). My research primarily focussed on the tutor (teachers and their leaders) and their need for a theoretical framework to support their educational practices. Multiple research projects and my research concluded that the successful implementation of an EET framework links to the teachers' level of competence, knowledge, skills, and capability. These levels of competence range from novice through advanced beginner, competent, proficient to expert (Benner, 1982).

The successful implementation of a technology framework further links to teachers' attitudes, beliefs, confidence, and readiness (Australian Council for Educational Research, 2013; Newhouse, 2014; Zagami, 2015). Petko (2012) identified that the will, skills and tools are essential for teachers' successful integration of EET in the student-

centred inquiry. Donnelly et al. (2011) concluded that a framework provided a means to raise essential questions about the effectiveness of leadership support required by teachers to function and progress between descriptors within the framework. They highlighted that change attempts should incorporate mixed strategies to meet the varying perspectives and levels of teachers' progress when adopting and using EET.

Some participants affirmed other requisites associated with the vision and goals of integrating EET. These related to the accessibility of learning resources; committed leadership within the organisation; operations and technical support within the infrastructure; assessment practices; sufficient time for teachers to learn, prepare and implement technologies; clear curriculum values; and addressing equity in situations where there is a disadvantage. T7 highlighted the importance of a patient attitude as frustrations may arise regarding the implementation of technologies.

Aligning with Ministry of Education requirements.

Within the New Zealand education context, accessibility to EET through the technology strand of the New Zealand Curriculum for English-Medium Teaching and Learning in Years 1-13 (New Zealand Ministry of Education, 2007b) continues to change. There are ever-increasing opportunities to integrate technologies provided by new hardware, software and apps. In this context, the teaching practice of integrating EET in pedagogy aligns with the five dimensions of the Ministry of Education's e-Learning Planning Framework and related Ministry of Education curriculum practices and pedagogy (New Zealand Ministry of Education, 2007b, 2017e). These five dimensions are leadership and strategic direction, professional learning, teaching and learning, technologies and infrastructure beyond the classroom (New Zealand Ministry of Education, 2017e).

The New Zealand Curriculum encourages schools to explore how EET can supplement traditional teaching practices and how they can open up new and different ways of learning to provide rich opportunities for education (New Zealand Ministry of Education, 2007b). Such opportunities arise through enabling relationships for learning, strengthening collaborative inquiry and building coherent pathways over the student year levels and across settings (New Zealand Ministry of Education, 2019a, 2019b; Te Wiata, 2016). The curriculum's content and the pedagogy goals of teaching that integrate EET follow and support the curriculum's vision for young people to become confident, connected, actively involved, lifelong learners (New Zealand Ministry of Education, 2007b).

Summary

In summary, the discussion of my four research questions concluded the following:

Concerning the first research question — how are teachers of students who are deaf or hard of hearing in New Zealand integrating emerging educational technologies into their teaching? — differing perceptions, skills, attitudes and beliefs influence the extent of teachers' purposeful integration of EET in their pedagogy. These interrelationships are complex and affect the way that all participants chose to use the technologies and how effectively they included these as resources and practices to assist language development, learning, explain abstract concepts, develop innovative approaches, communicate, collaborate, and connect with families (Prestridge, 2011; Scherer et al., 2018).

Concerning the second research question — what are the opportunities and challenges faced by teachers of students who are deaf or hard of hearing, and the support required by them to integrate emerging educational technologies into their pedagogy? —

both the research conclusions and the participants' opinions established that EET provided opportunities to support and engage students who are DHH in learning in additional ways to their mainstream peers. The reason is that these technologies provide visual access to clarify abstract concepts and scaffold language development, communication and knowledge. Another opportunity for integrating EET is that, with the right approach, they can support social skills development and interactions. Besides this, EET can provide immediate access to assessment that, in turn, supports teachable moments.

Challenges teachers experienced in integrating EET are that change is rapid with insufficient time to experiment and learn about EET. This situation, and the extent of the effectiveness of the strategic planning of leadership, in turn, affected all participants' levels and ability of implementation. Other challenges may occur when working with uncooperative mainstream schools to provide inclusion in education and access to their broadband, services and professional learning. Also, some students' addictive technology behaviours and inappropriate use of technologies may prove challenging. Further, teachers face other day-to-day challenges when integrating EET in their teaching.

The third research question — what features of the emerging educational technologies do teachers of students who are deaf or hard of hearing perceive as positive and negative to student-centred inquiry outcomes and social growth? — concluded that new technologies might increase students' engagement and motivation, facilitate clearer thinking and enhance students' learning interests. New technology content may also increase personalised learning and willingness to engage in learning. Technology content may develop data for the interpretation of students' skills, cognition and social processes. It may further provide resources that consider the individual, cultural, and developmental differences of students through presentation, demonstration, drill and practice, interaction

and collaboration (Bingimlas, 2009; Hwang & Wu 2014; Roblyer & Doering, 2014). On the other hand, there needs to be an awareness that, if not purposefully integrated, EET may be ineffectively used, prevent collaborative communication and may not be responsive in preparing teachers and their students for the global digital world.

The fourth research question — what leadership practices do teachers of students who are deaf or hard of hearing perceive as enabling or hindering the equitable implementation of emerging educational technologies for student-centred inquiry? — discussed the participants' views on leadership to provide enabling conditions and equitable access to EET. These conditions include investing in teachers' professional learning, ensuring equal access to EET infrastructure and resources, and valuing and taking the time to connect with parents/whānau and stakeholders through emerging educational technologies. Collectively, participants' data identified three leadership attributes that support the practice of integrating EET into pedagogy. These attributes are strategic navigation of leadership through periods of change; leadership that is relational and achieved through effective communication; and operational leadership to bring about the integration and sustainability of EET.

Two participants suggested the reinstatement of the equivalent position of an e-learning leader. A further opinion related to the practice of distributed leadership, whereby staff skills are recognised, and staff are empowered to lead aspects of emerging educational technologies. Another belief concerned the prudent use of the budget by leaders and management for new purchases, maintenance and succession planning of EET. This view aligns with that of Bingimlas (2009) and Zagami (2015), who discussed the importance of a budget for technologies.

Most participants referred to the role of leadership to establish collaborative learning communities, especially in the light of the imminent merger of the two deaf education centres. T8 put this as:

I think the big change concerns how Kelston and van Asch worked as separate entities. This is now changing as these two organisations are looking towards a merger. Office 365 is allowing us to share our resources and work on the same platform, but it's still early days. (T8)

This chapter concluded with a discussion on the significance of the TPACK framework (Koehler & Mishra, 2009; Mishra & Koehler, 2006) as a paradigm for teachers to leverage EET as essential resources and practices in the pedagogy of students who are DHH. The TPACK framework accommodates recognition of changes in pedagogy and content knowledge required by teachers when including technology to facilitate students' learning (Newhouse, 2014). Changes may include an adjustment in beliefs, attitudes, abilities, confidence levels, pedagogy instructional practices, strategies and methods. The culture within which teachers learn and work may benefit if it embraced, owned and nurtured their vision about the use of EET within the TPACK framework (Ertmer & Ottenbreit-Leftwich, 2010). From this discussion, it became evident that adaption of TPACK might meet the context of the education of students who are DHH and lead to an expanded TPACK framework (Koehler et al., 2013) to accommodate the unique learning requirements of students who are DHH. I discuss this further in Chapter Six, which also proposes recommendations for future research, based on my data results in Chapter Four and discussion in Chapter Five.

Chapter Six: Recommendations and Conclusions

Ma te whiritahi, ka whakatutuki ai nga pumanawa a tangata: Together weaving the realisation of potential. (New Zealand Ministry of Education, 2019b. p.1)

The recommendations and conclusions of my study problem and purposes aimed to contribute research to the gap in the literature on how teachers of students who are DHH integrate EET into their pedagogy to support the education of these students. In this chapter, I present an overview of my explanatory sequential mixed methods research. This research sought to answer four questions on the integration of EET by teachers of students who are DHH in New Zealand to support, enrich and enhance the language development, learning progression and social growth of these students. I put forward eight findings resulting from quantitative and qualitative data from two research instruments gathered at one point in time: an online survey and in-person interviews. I then discuss elements of a holistic framework for EET integration in pedagogy. Next, I provide five recommendations for integrating EET in teaching practices. I then clarify the limitations, present five proposals for further study, summarise the research structure, and reflect on this research's conclusions.

Introduction

My research intended to contribute to the under-researched and limited empirical evidence on the integration of EET by teachers of students who are DHH. Such contribution encourages future and further investigation on equitable and inclusive EET integration in the teachers' pedagogy supported by leadership to provide meaningful and sustained EET integration in teaching. Interestingly, my research data revealed the necessity for a common understanding of EET integration practices in student-centred

pedagogy to increase language acquisition, learning outcomes and social growth. Such collective agreement appeared pivotal for anchoring EET integration in a framework when teaching students who are DHH. I, therefore, scrutinised the participants' data, literature and various theoretical frameworks, such as the TPACK framework (Koehler & Mishra, 2009), to determine the elements and contexts that support and enhance successful EET inclusion in teaching.

Four questions guided my investigation of the teachers' views on their pedagogical integration of these technologies. Three questions explored the teachers' experiences of EET in pedagogy, and one investigated their perceptions of leadership supporting this integration.

Question One: How are teachers of students who are deaf or hard of hearing in New Zealand integrating emerging educational technologies into their teaching?

Question Two: What are the opportunities and challenges faced by teachers of students who are deaf or hard of hearing, and the support required by them to integrate emerging educational technologies into their pedagogy?

Question Three: What features of the emerging educational technologies do teachers of students who are deaf or hard of hearing perceive as positive and negative to student-centred inquiry outcomes and social growth?

Question Four: What leadership practices do teachers of students who are deaf or hard of hearing perceive as enabling or hindering the equitable implementation of emerging educational technologies for student-centred inquiry?

Further, I trust that this research is significant, transferable, and replicable in similar and other population groups and communities to understand their current teachers' EET integration for providing a foundation to build practices anchored in an EET framework. I next recount the eight findings of my study.

Findings

My literature findings (Chapter Two), the 79 survey responses, and the 14 interviews (Chapter One and Three) provided quantitative and qualitative data on the research problem. Collectively the participants identified that integrating EET into teachers' pedagogy includes both positive and adverse influencing factors and occurs as a slow and complex process with many (Lawrence & Tar, 2018). I present eight findings related to conclusions drawn from investigating the four research questions. Seven findings relate to matters concerning the integration of EET in pedagogy. The eighth finding relates to theoretical intents and covers a reflection on the contextual influences of the TPACK framework (Koehler & Mishra, 2009).

Multiple variables influence the integration of EET in pedagogy.

My studies affirmed the findings of Kale and Goh (2014), Mohamed (2018), and Morris (2010) that variables affect the way teachers choose to use EET. The teachers' approach determined how successfully they integrated these into their pedagogy. Variables that influenced the participants' willingness to engage with and integrate EET purposefully in their pedagogy included their belief, perception, attitude, motivation, and patience. T3 described this situation as, "The use of technology is a personal preference. You, therefore, have staff who embrace the new technology and new way of working, and staff who don't want to".

Other variables amongst the participants included their approach to current knowledge of EET, the demographic distribution of students, the ease of access to EET, and the school's support or provision for students who are DHH. Regarding attitude towards the inclusion of EET, T7 said, "I think the most important thing is attitude. I think people have to have that open mindset, a growth mindset".

Personal entrepreneurship appeared as a primary characteristic of all participants who integrated the innovative use of EET in their pedagogy. T2 described this characteristic as, "It's getting to know what's out there and becoming aware that it is out there, and then using your initiative and also working with the students and the other teachers".

Drent and Meelissen (2008) and Morris (2010) identified a similar profile of entrepreneurial and innovative teachers who integrate EET in their pedagogy, namely the participants' willingness to keep extensive contact with colleagues and experts in EET for continued professional learning. The profile further involved the teachers' attitude of perceiving EET as holding innovative advantages for their pedagogy in the student-centred inquiry, which T2 described as, "Between my students and me we've lifted all of us in the use of technologies, that is, we've lifted each other up".

Equity of access to EET is essential.

At the time of the study, an unintended finding revealed that inequity and considerable variation existed in terms of teachers' and students' access to EET. T9 commented on this situation, "If we want the best for our learners, then we should be really strong on equity". Some teachers, especially those teaching in modern learning environments, felt more favourably placed for integrating EET in their pedagogy. They believed that this environment contributed to their students' improved motivation, learning and digital literacy.

My survey data and interview conclusions on equity aligned with Gil-Flores et al. (2017). They observed that school cultures with equitable EET distribution also provided professional learning and collaboration to use these. Further, such school cultures developed self-efficacy and increased the teachers' pedagogical competence and confidence in EET use. Conversely, the data showed that some participants felt isolated and unsupported in their requirements for integrating EET in their teaching and learning. T3 described this experience as, "One of the challenges that I usually complain about is the issue of equity. We are always on the back foot playing catch-up".

EET provide visual access for learning.

A strength of EET is that they provide visual access and clarity to language acquisition, knowledge, and abstract concepts for students who are DHH in ways additional to their mainstream peers (Berent et al., 2008). The visual features of EET can support scaffolding and differentiated learning to accommodate individual differences (Borgna et al., 2010; Salbego et al., 2015). EET allow teachers and students to visually share learning, planning and goals to support, extend and enrich language development, learning progression and social growth (Dye et al., 2008). T6 said that "just having so many visuals to see the context of things and access sign language is superb". Further, these visual strengths can support access to assessment that, in turn, assists teachable moments, the development of social skills, interactions, and student responsibilities. Therefore, the visual strengths of EET appear to equip students for both the current and the future world (Bentley et al., 2019; Hersh, 2017; Villagrasa et al., 2014).

Collaboration through EET broadens learning and social inclusion.

The literature review, data results and discussion collectively concluded that collaborative skills are intertwined with pedagogy and EET to support learning and

positively influence education (Valtonen, 2017). T7 indicated that for the education for students who are DHH, “Collaboration is important for working alongside colleagues, and I think technology has made that happen”. T14 added, “We collaborate to create learning outcomes and resources to support student learning and independence”. Such participants' experiences corroborate the findings of Fullan and Langworthy (2013), Morel (2014) and Vandenhouten et al. (2014) that the development of collaboration for learning and social inclusion requires the integration and sustainability of EET in a safe, organised and well-managed community of learning.

All participants reported challenges relating to collaboration for learning and social inclusion when working with mainstream schools and provisions. These challenges occur in terms of equity, integration, access to adequate technology resources, broadband, technology services and support, and professional learning (Xie et al., 2013). Salter et al. (2017) urged that collaboration in the cultural context of the education for students who are DHH needs to extend to inclusive settings in mainstream schools.

All participants used some form of EET for collaboration and social inclusion. This conduct aligns with research on this practice. Examples of collaborative use of EET was Zoom video conferencing for meetings, discussions, and national staff gatherings (Konrad, 2020; Morgan, 2019). Other collaborative technologies used by participants included shared Google Docs (Frigo, 2018; Mahaffey et al., 2020) and Microsoft Teams (Buchal & Songsore, 2019; Lansmann et al., 2019). Added collaborative technologies were Outlook and Gmail e-mailing (Filippone & Survinski, 2016; Hochbein, 2020), scanned information and PowerPoints (Konstantinidis et al., 2017; Pros et al., 2013). Other collaborative technologies included blogging (Akdag & Özkan, 2017; Krish et al., 2012; Speranza, 2015), in-person online contact through mobile calls, and collaborative apps such as Padlet (Fisher, 2017; Leinonen et al., 2016; Wright, 2017).

Strategic direction is essential for the integration of EET.

Ample worldwide research findings confirm the significance of strategic educational leadership for successfully implementing EET (Kazim, 2019; Webster, 2016, 2017). Such attributes play an essential role in how teachers integrate EET in their pedagogy to meet the curriculum's goals (New Zealand Ministry of Education, 2007b, 2020). Three attributes highlighted by the participants included leadership in times of change, relational leadership, and the provision by leaders of a supportive learning environment.

Leadership in times of change.

A leadership attribute that appears to support the practice of integrating EET into pedagogy is strategic navigation through periods of change (Afshari, 2012; Davies, 2010). Regarding change relating to EET, T7 stated, "What's important is that these changes are suitable for our environment of deaf education. We have to make sure that we utilise those applications to accommodate our uniqueness". Regarding the timing of change, T9 believed, "Change is good, but change is best at the start of the year".

Relational leadership.

Of equal significance for integrating EET is relational leadership that comes through positive and effective communication and collaboration (Nicholson & Kurucz, 2019). Regarding such leadership, T7 identified that "it needs to be about supporting and empowering teachers and establishing the vision and the goals and explaining these in a way that they can understand and follow".

Leadership for the operational implementation and maintenance of EET is required when planning the strategic direction for adequate lifelong professional learning and training (Chang et al., 2008). Participants were mainly of the view that professional learning required strategic planning. Regarding this, T8 indicated, "I would prefer more

professional development within my role. Technology is great, and I have got lots of those skills, but I would like more support in using them appropriately in education”. Such professional learning requires relational support, time, and ownership opportunities for the teachers (Davies, 2010; Schachter, 2010).

Supportive learning environment.

To support the teachers' initiative, it appears essential that the schools' leadership needs to create favourable conditions for realising the innovative uses of EET in pedagogy (Davies, 2010; Nicholson & Kurucz, 2019). T7 explained, “Leadership is about supporting people to accept the changes and feel satisfied and happy with the changes. It is about listening to people’s understanding and frustrations and managing them to adopt the technology practices the leader wants to establish”.

Therefore, the conclusion is that balancing the teachers' entrepreneurship through supportive school leadership and management encourages the ‘bottom-up’ integration of innovative EET and a holistic ‘top-down’ perspective (Fullan 2001).

Professional learning and time are required to assimilate EET.

In the literature (Chapter Two), survey and interview data (Chapter Four), I found that participants placed a high priority on the benefits of professional learning for integrating EET in their pedagogy to support their delivery of the curriculum (Drent & Meelissen, 2008; Kazu, 2011; Morris, 2010). However, my findings also revealed that a lack of time affected all participants’ levels and ability to effectively integrate and implement new knowledge of these technologies (Chang et al., 2008; Davies, 2010; Schachter, 2010). T4 captured this view, “As a busy teacher, time doesn’t allow for the kind of play to develop an in-depth understanding of what a particular technology offers”. Therefore, purposeful professional learning requires adequate time to

experiment, learn, and integrate new skills and practices related to EET (Alenezi, 2019; Darling-Hammond et al., 2017; Hsu, 2016). Also of interest was that the participants, at the time of my study, mainly were unfamiliar with the recent addition of Digital Technologies/Hangarau Matihiko (New Zealand Ministry of Education, 2017a) to the current technology curriculum (New Zealand Ministry of Education, 2007b), which becomes mandatory in 2020. This situation will, therefore, require strategically planned professional development.

Awareness of safe practices in the use of EET is imperative.

Slonje et al. (2013), Smith (2015), and Yu (2011) concluded that the awareness and implementation of safe practices in the use of EET required greater understanding and attention to avert adverse consequences. Of particular interest is the finding that participants mainly had not thoroughly considered issues relating to confidentiality, net safety, cyberbullying, privacy, and copyright. Further, participants did not raise the matter of the potential of EET to compromise their own and their students' physical health (Zlamanski & Ciccarelli, 2012).

The TPACK framework requires additional contextual influences when integrating EET in the education of students who are DHH.

My research puts forward that, for the education of students who are DHH, the dimensions of technology, pedagogy, and the contexts of the content of the TPACK framework (see Figure 27) align with the Board's Charter values (see Table 22) (Combined Board of Trustees, 2019; Koehler et al., 2013; Mishra, 2018).

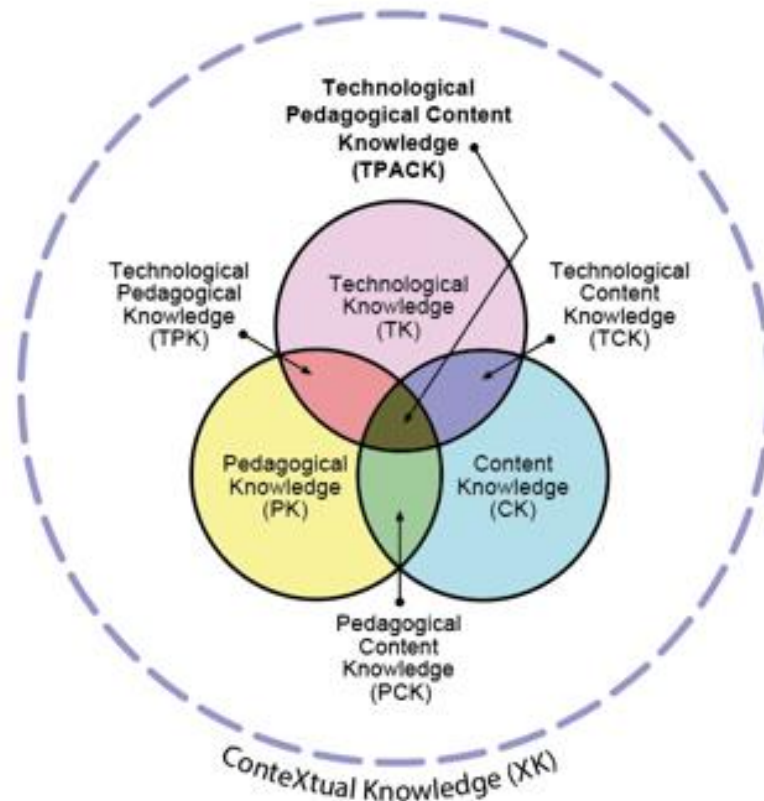


Figure 27. The TPACK framework © Punya Mishra, 2018. Reproduced with permission.

However, based on the data from the survey and interviews, three additional contextual influences and one expanded contextual influence require consideration for inclusion in the TPACK framework (Mishra & Koehler, 2009a, 2009b). First, these contextual influences capture the requirement for access to language and information, secondly for strategic leadership to integrate EET, and thirdly to accommodate the implications of these tools' fast-paced and rapid changes. Fourthly, the contextual influence of teacher training identified by Mishra and Koehler (2009b) requires expanding to include ongoing lifelong professional learning and growth. I will discuss these proposed additional contextual influences in the recommendations section and Figure 29 of this chapter.

A holistic framework for EET integration in the learning of students who are DHH.

From my literature review and data findings, I developed a concept for integrating EET in pedagogy for students who are deaf or hard of hearing. I illustrate this concept titled, ‘Integration of emerging educational technologies in learning for students who are deaf or hard of hearing: IEET-DHH concept (Baker, 2020)’ in Figure 28. The IETT-DHH concept intends to encapsulate the holistic requirements for these students’ education concerning integrating EET in teaching. It consists of six elements that support teachers’ professional knowledge and skills regarding integrating EET in their pedagogy. This concept assimilates the research’s data findings and the explored theories in this study relating to integrating EET in pedagogy. I explain the six elements in the section below.

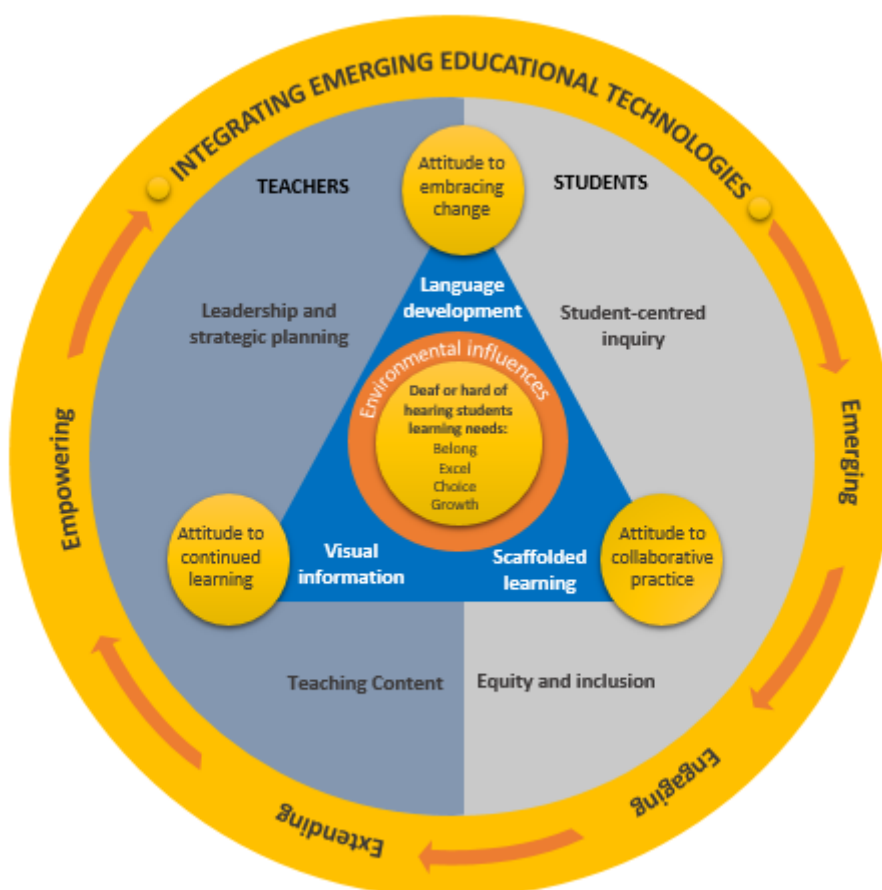


Figure 28. Integration of emerging educational technologies in learning for students who are deaf or hard of hearing: IEET-DHH concept (Baker, 2020).

Elements of the IEET-DHH Framework.***Student learning.***

At the centre of the diagram, the first element illustrates the requisite for a purpose to integrate EET in teaching students who are DHH. This overarching purpose supports these students' language development, learning progression, and social growth and increases their opportunities to belong, excel, grow, and make choices (Combined Board of Trustees, 2019; Education Review Office, 2016c; Shahhoseiny, 2013).

Personal and environmental influences.

The ring around the inner circle indicates the second element: personal and environmental circumstances influence the students' life and learning experiences. Teachers, therefore, need to consider how EET may potentially support student learning in these contexts. Two models recognising the influence of these contexts on education are the bioecological model of Bronfenbrenner (Bronfenbrenner & Morris, 1998; Rosa & Tudge, 2013) (Figure 2) and the TPACK framework Koehler and Mishra (Koehler & Mishra, 2009) (Figure 27). Bronfenbrenner concluded that such contexts arise from the individual students' character, abilities and skills and their experience of environmental influences identified as the micro, meso, exo, macro and chrono systems (Anderson et al., 2014; Kampenopoulou, 2016). Koehler and Mishra (2009) identified six significant situational and personal contexts on learning when including EET in pedagogy. These six contextual influences on TPACK are experiences, students, resources, aims/objectives, attitude, and teacher training.

Further, cultural diversity requires recognition in education to meet the learning needs and aspirations resulting from the diversity. New Zealand acknowledges the diverse population profile of its society by being a country led by the principles of partnership, protection and participation as stated in the Treaty of Waitangi (Clements,

2016; D’Cunha, 2017). These principles need to be evident in the school curriculum's interpretation and implementation and applied in the classroom. All students can thus have the opportunity to acquire knowledge of the language and its cultural practices/te reo Māori me ōna tikanga (New Zealand Ministry of Education, 2011b, 2013b).

Priorities for student-centred inquiry of students who are DHH.

Three fields of the triangle indicate the third element. The three fields specify essential pedagogies in the education of students who are DHH. These are focus on the priorities of language development, visual information and scaffolded learning for student-centred inquiry. Further, the triangle implies that the content and design of software and apps need to accommodate accessibility and inclusivity for the unique requirements of language development, learning progression and social growth in the education of students who are DHH. Therefore, software and apps become significant in this education when their content and design accommodate these students’ requirements for language development, visual information, and scaffolded learning (Baglama et al., 2018; Beal-Alvarez & Cannon, 2014; Capuano et al., 2011).

Attitude.

Three circles portray the fourth element, one on each point of the triangle, indicating teachers’ attitudes necessary to integrate EET in pedagogy positively (Aldunate & Nussbaum, 2013; Bonfiglio-Pavisich, 2018; Claro et al., 2018). A positive attitude requires an approach that embraces change, is comfortable with collaborative practices, and shows a willingness to participate in continued professional learning relating to EET integration (Donnelly et al., 2011; Ertmer et al., 2012).

Pedagogical practices.

The fifth element, located outside the triangle, consists of four fields that indicate the prominence of the four teaching practices. Two practices relate to the teachers' pedagogy and two to the teachers' engagement with the students.

The two parts relating to teachers' professional practice firstly concern the support of leadership through strategic planning and a dedicated budget (Australian Council for Educational Research, 2013; Kurian & Ramathan, 2016; Rotolo et al., 2015), distributed leadership (Harris et al., 2013; Ho & Ng, 2017; Lommen, 2016) and meeting the grassroots requirements of teachers (Benkinson, 2015; Hadjithoma-Garstka, 2011; Nicholson & Kurukz, 2019). The second part acknowledges a theoretical base on which to build teaching content in the practice of integrating EET in pedagogy (Altuna & Lareki, 2015; Anderson, 2016; Crawford, 2010). The TPACK framework (Mishra & Koehler, 2009b) is a model of a theoretical foundation for basing teaching practices on that integrate EET.

The two parts concerning teachers' pedagogy firstly require best practices for the student-centred inquiry to support language development, learning progression and social growth (Ramoroka et al., 2017; Tondeur et al., 2008; Wallace Foundation, 2013). The second part recognises equity, inclusion and availability of technology resources to overcome barriers, socio-cultural issues, distance and environmental challenges (Constantinou et al., 2018; Cotter, 2018; Taylor & Packham, 2016).

Recognition of differing levels of practice and experience.

The sixth element, depicted by the outer ring, indicates that individuals might be experiencing the integration of EET at differing personal and group levels at any given time. These levels could be either at an emerging, engaging, extending or empowering

level (Bers, 2010; New Zealand Ministry of Education, 2014a; Osterman, 2012). I next put forward five recommendations arising from this study.

Recommendations

Based on the discussion originating from the research questions (Chapter One), the literature review (Chapter Two), data findings (Chapter Four) and the inclusion of a theoretical framework (Chapter Five), I offer five recommendations. These recommendations, directed to teachers of students who are DHH, are for their consistent and sustained implementation of the practice of integrating EET in pedagogy. The recommendations intend to progress the significance of my research, as described in Chapter One and contribute to the literature gap on integrating EET in pedagogy.

The first recommendation considers the inclusion of a theoretical framework, such as the TPACK framework (Koehler et al., 2013; Mishra & Koehler, 2009b) to underpin the practice of teachers' inclusion of EET in their pedagogy. However, the TPACK framework would require additional contexts to accommodate the uniqueness in the education of students who are DHH. These contexts are access to language and information, leadership, rapid change and lifelong learning.

The second recommendation relates to recognising the role of leadership in strategic planning for integrating EET. The third recommendation concerns ensuring a dedicated budget for EET staffing, purchases and maintenance. The fourth recommendation calls for the implementation of strategic life-long professional learning. The final bid is to create a collaborative culture of practice. These recommendations intend to inform the New Zealand Ministry of Education, professionals, policymakers, stakeholders, educational leaders, teachers and researchers on the equitable, innovative and future-focussed integration of EET in pedagogy, mainly when teaching students who are DHH. I now discuss these five recommendations.

Use of a theoretical framework.

The first recommendation is that policymakers, educational leaders and teachers use a theoretical model, such as the TPACK framework (Figure 27), as a foundation to define and facilitate the integration of technology in teaching (Baran et al., 2011; Mishra & Koehler, 2009b). This recommendation, derived from the third research question's data that, amongst others, indicated a low application of a consistent theoretical framework when integrating EET in practice. However, such a framework requires acknowledging that pedagogy, rather than the EET, precedes the students' language development, learning progression, and social growth (Convery, 2009; Cuban, 2018; Donnelly et al., 2011). This acknowledgement implies that EET may assist, support, extend, and enrich pedagogy to meet the students' progress through the curriculum subjects' levels. In this regard, T9 reiterated, "We need to be very clear that it's good teaching that drives technology, not technology that drives good teaching". As such, the application of EET is supplementary to regular teaching. Further, such a framework requires the inclusion of sign language translation and captioning to ensure equitable access to knowledge and information for both urban and geographically remote teachers and students.

Recommended additions to the contextual influences of the TPACK framework.

I recommend three additional contextual influences and an expansion of one existing contextual influence when considering the design of the TPACK framework of Tunjara et al., 2016, p. 3093) as a theoretical basis for integrating EET in the pedagogy of teachers of students who are DHH (see Figure 29).

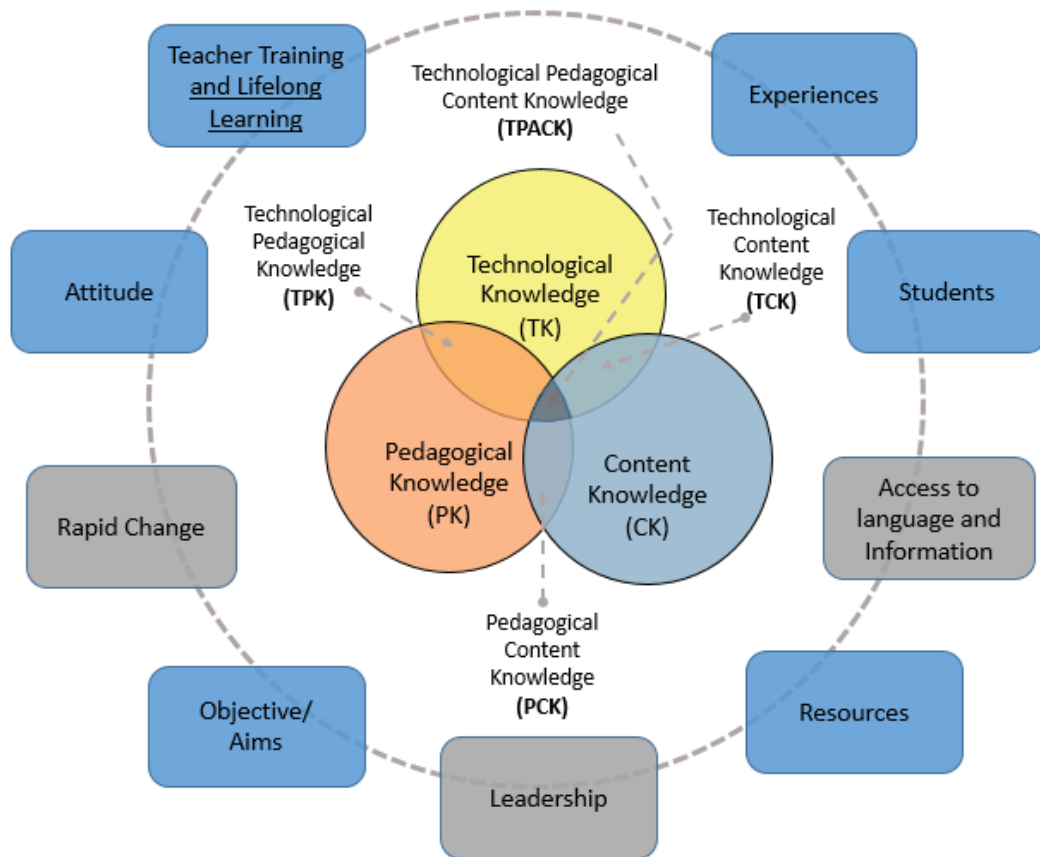


Figure 29. Proposed TPACK framework for inclusion in teachers' pedagogy of students who are deaf or hard of hearing (Adapted from tpack.org and Tunjera et al., 2016, p. 3093).

I indicated (in grey) three other contextual influences, based on my findings, that appear to be essential for the education of students who are DHH. The possible benefit of including these additional contextual influences within the TPACK framework is that they may support the integration of EET in the pedagogy of these students' education (Koehler et al., 2013; New Zealand Ministry of Education, 2007b). The three recommended contextual influences are access to language and information, leadership, and rapid change accommodation. The expanded context on teacher training requires recognising and providing for the importance of their continued lifelong learning. Each

additional recommended contextual influence is next defined and includes one participant sample statement supporting the reason for the recommendation.

Access to language and information.

Access to language and information recognises and accommodates the bilingual/bicultural requirements or spoken language requirements of these students, and the EET needed to support this learning (Knoors & Marschark, 2015; New Zealand Ministry of Education, 2015a, 2015b). T8 believed that "... for students who are DHH, there is so much potential for using educational technologies that access and progress language development".

Leadership.

All participants highlighted the need for strategic leadership direction regarding the integration of EET in their pedagogy. I, therefore, recommended this addition to the contexts of the TPACK framework when applied to the education of students who are DHH. Research and the Board of Trustees of the two deaf education centres also recognise leadership's strategic context (Bolstad, 2017; Combined Board of Trustees, 2019; Veletsianos, 2016). T7 was of the opinion that "...it's about fostering those leadership skills, so everything works really successfully".

Accommodation of rapid change.

Research amply recognises the impact of change and the adaption required to keep pace with this (Beal-Alvares & Cannon, 2014, Consortium for School Networking, 2019; Rotolo et al., 2015). T10 stated, "I place a lot of value in things that change my mindset in how I am teaching the kids". Therefore, the impact of change requires recognition in a theoretical framework related to integrating EET in pedagogy.


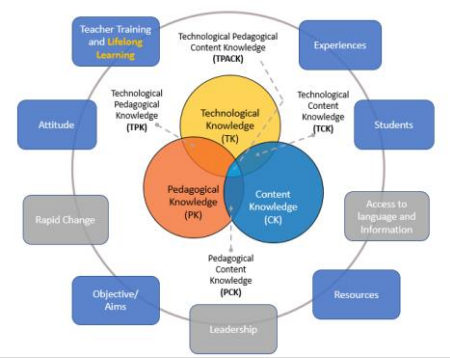
Lifelong professional learning.


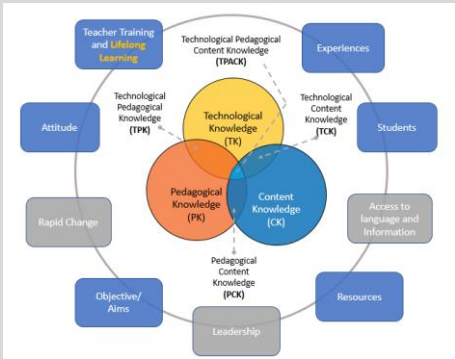
The expanded concept (underlined wording in the blue box) of teacher training now includes lifelong professional learning in EET (Consortium of School Networking, 2019; Gil-Flores et al., 2017). T11 believed that “Consistency of learning about new tools over a year, or maybe six months, and then introducing another new one is a good way to go”.


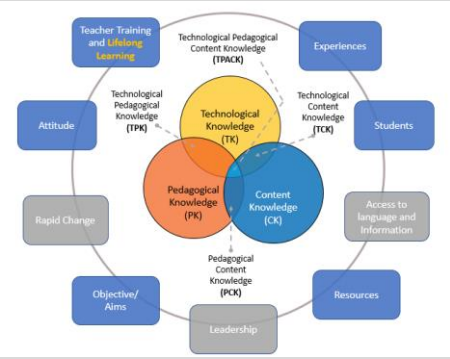
I reflected on each of the seven goals of the Board’s 2019 strategic plan and then offered an argument alongside each goal to support the presence of the adapted TPACK framework to anchor pedagogy that integrates EET (Koehler et al., 2013; Mishra & Koehler, 2006; Mishra & Koehler, 2009b). In Table 22, I identify each of the seven goals for the language development, learning progression and social growth of students who are DHH. Alongside each goal, I state how its implementation can be supported by the adapted TPACK framework, as explained in Figure 30.

Table 22

TPACK Framework Support of the 2019 Combined Board's Strategic Goals

	<p>2019 Strategic Goals of the Board</p> 	<p>Adapted TPACK Framework</p> 
1.	<p>Develop a progressive, holistic service for students who are DHH that maximises educational, social and emotional outcomes, and is accessible, equitable and efficient in terms of its national delivery.</p>	<p>The utilisation of the adapted TPACK framework (Koehler et al., 2013) permits continuous reflection for improving methodology that integrates EET in education. Cycles of reassessment and evaluation make it easier to progress towards higher learning levels through the informed decisions of strategic planning (Davis et al., 2015; Eacott, 2013; Firestone & Robinson, 2010).</p>
2.	<p>Develop one new national organisational structure that enables excellent educational outcomes for students who are DHH across New Zealand.</p>	<p>Adopting the adapted TPACK framework may allow for the collection of national data for decision-making by the Board and principals about technological goals that are personalised to the students' learning and social requirements (Combined Board of Trustees, 2019; Koehler et al., 2013).</p>

	<p>2019 Strategic Goals of the Board</p> 	<p>Adapted TPACK Framework</p> 
3.	<p>Inform discussions, priorities, and resourcing by utilising data, evidence-based best practice and research that underpin the child-centred values of excel, choose, grow and belong.</p>	<p>TPACK (Koehler et al., 2013) is intended not only as a diagnostic tool but also to identify best practice when including EET in teachers' pedagogy (Bolstadt et al., 2012; Tondeur et al., 2008; Wallace Foundation, 2013). The TPACK framework may provide a means for self-assessment, improved strategic planning and practices towards excelling, making good choices, growth and a sense of belonging (Koehler & Mishra, 2013; Koehler et al., 2013). Further, the TPACK framework (Koehler et al., 2013) can align with the teaching and learning cycle of the Combined Board's vision and educational requirements.</p>
4.	<p>Lift individual and collective student social development and achievement through high-quality teaching and learning pathways.</p>	<p>TPACK is inclusive of the concept of utilising the hardware, software and apps in ways that support the healthy social growth and interaction of students with each other and with those around them (Koehler et al., 2013). The elements of the adapted TPACK accommodate features of social growth such as the development of language skills, building self-esteem, strengthening learning skills, resolving conflict and establishing positive attitudes (Koehler et al., 2013; Whitehead, 2017).</p>
5.	<p>Build and maintain strong, collaborative relationships with</p>	<p>The integration of EET within the TPACK framework may support collaborative relationships, particularly with the students' parents, family / whānau, network of supportive people, and school of</p>

	<p>2019 Strategic Goals of the Board</p> 	<p>Adapted TPACK Framework</p> 
	<p>students, family/whānau, the deaf community, the wider education community and other external stakeholders.</p>	<p>attendance (Koehler et al., 2013; Marks, 2018). The purpose would be to provide an improved environment where all involved can utilise the benefits of EET to extend and enrich the homework, language development, learning progression and social growth of the students.</p>
6.	<p>Use and manage resources to provide the maximum educational benefit for our students.</p>	<p>Adopting the TPACK framework may promote a climate of innovation, motivation, creativity and ingenuity in education (Koehler et al., 2013). Further, TPACK (Koehler et al., 2013) may target appropriate interventions and resources to ensure adequate progress throughout the students' developmental stages (Firestone & Martinez, 2007; Leithwood & Mascall, 2008; Ramoroka et al., 2017).</p>
7.	<p>Align property and infrastructure to support a nationwide service delivery framework.</p>	<p>Reflection on the TPACK framework components may support the setting up of a stable future-directed technology network, which includes new capabilities as they become viable (Koehler & Mishra, 2013; Koehler et al., 2013). The adapted TPACK framework might help identify appropriate strategies to measure the impact of specific uses of EET for new ways of learning and attaining knowledge (Koehler & Mishra, 2013; Koehler et al., 2013).</p>

Leadership and strategic planning.

Findings related to the fourth research question led to the second recommendation. These findings call for leadership to action strategic planning that creates an educational environment that integrates EET according to informed decisions and an understanding of current trends. Such a strategically planned environment require sustainability through the regular assessment of the relevance of the resources and practices (Hargreaves & Goodson, 2006; Nicholson & Kurucz, 2019). Strategic planning also considers the students' age, the user's needs, teachers' presence, and independent use of students' applications (Elsendoorn, 2002). Such planning would include recommendations on trust and ethics to ensure student and staff well-being in the use of EET (Lommen, 2016). Strategic leadership calls for a commitment to distributed leadership that recognises teachers' skills by providing them with opportunities to lead in relevant aspects of EET (Harris et al., 2013; Ho and Ng, 2017).

These research findings affirmed the observation made by most participants that strategic leadership requires leaders' opportunities to consult with teachers at a grassroots level. Such consultation ensures that technologies meet the specific day-to-day requirements of their educational practices at the schools, which teachers and students visit and attend. Further, these participants believed that leaders' grassroots consultation needs to address the removal and replacement of obsolete technology and practices and exchange these with present-day equipment and methods. For T12, this implied that "Leadership needs to keep up with technology and thinking about what is happening on the ground. This relationship between them and us is important because we use technology, and they are the ones deciding which technologies we will use".

Considerations in strategic planning for EET integration.

The two research instruments' data disclosed that strategic planning for integrating EET in pedagogy includes six considerations. I use Figure 30 to explain these six considerations.



Figure 30. Considerations for strategic planning when integrating EET in pedagogy.

The first consideration is that strategic planning requires a budget for technology-related expenditures, timelines for implementation and renewals, and professional learning on new technologies and innovative teaching and learning practices. Regarding a budget for EET, T10 stated, “You need to know what you can spend the money in the budget on”. T14 is of the view that “For budgetary initiatives, I would love to see more teaching staff being involved in budget-making to disperse it evenly for more meaningful implementation”.

The second consideration is that strategic planning enables opportunities and time for exploring and integrating EET to support innovative teaching and learning practices. The third consideration is that strategic planning supports the administrative operations required by teachers and their leaders to align technology and teacher expertise with learning expectations and pedagogy. These responsibilities include assessment, review and measuring the influence of the integration of EET.

The fourth consideration is that strategic planning recognises the importance of assessment through reflection, regular review and monitoring. Assessments further allow for a correction process and measure the current influence of EET integration in teachers' pedagogy for language development, learning progression, and social growth. The fifth consideration is for strategic planning to consider ways of including the students' family/whānau and friends, who may also need to work with the technology.

The sixth consideration is that strategic planning recognises the significance of new and rapid changes and accommodates the implications of applying changes concerning technology, pedagogy and content knowledge. T1 stated the benefit of a positive approach to change, "I try to focus on the positive things about new systems, technologies and change, rather than the things we can no longer do because we're not using the old system".

Provision of a committed budget.

The third recommendation derives from data addressing the second, third and fourth research questions. It recommends a dedicated budget to ensure finances for the equitable distribution and access to the resources and practices of EET (Roblyer & Doering, 2014). A committed budget also provides for the provision of technical support staff and technology services. This budget accommodates the cost of professional learning and the maintenance of effective and user-friendly technology infrastructure.

Funds for an EET budget mainly derive from a portion of the two deaf education centres' annual budget provided by the New Zealand Ministry of Education. Some funding derives from grants and sponsorships. Some participants discussed the need for prudent use of the budget for technology expenditures to provide consistency throughout the two deaf education centres. T7 was of the view that "It's important when you're planning the budget to consider what the needs are out there and glean this information from those working on the frontline and talking to people so that the priorities can be figured out".

Two participants recommended that staffing continue to include a budget for a digital-learning leader's ongoing position to coordinate professional learning relating to EET in teaching. T11 said about this, "I liked when we had the position of e-learning leader. I liked the support and the way that worked. I felt the guidance was effective".

Implement integrated professional learning.

The fourth recommendation also derived from data on the second, third and fourth research questions. The recommendation is to have a dedicated plan for ongoing informal and formal professional learning for staff concerning the operation and application of current and new EET for teaching and learning. While professional learning should not focus exclusively on technology integration, it would be encouraging when all professional learning activities seamlessly include technology in teaching curriculum content and skills (Schrump & Levin, 2013).

Both research and the participants' comments indicated that there are various means of attaining professional learning. It may originate from role models and mentors who support teachers' confidence in teaching in an emerging educational technology-rich learning and socially engaging environment. Professional learning may also derive from an Intranet-based hub with learning modules, articles and information to support a student-centred inquiry environment. Other means of professional learning derive from

professional learning communities, either in-person or virtually or as negotiated with leadership; and through assessment of and reflection on progress (Inan & Lowther, 2010a, 2010b; Papanastasiou & Angeli 2008). Such professional learning requires dedicated time to experiment and build skills to include EET in teaching practices (Kopcha, 2010; Prieto-Rodrigues, 2015; Zlamanski & Ciccarelli, 2012).

Create a collaborative culture of practice.

The fifth recommendation concerns creating a culture of collaborative practices and mainly derived from data that addressed the third research question. In the New Zealand context, the use of EET for collaborative practices and strengthening bonds should be encouraged between schools, which the students attend, the two deaf education centres and the international world of people who are DHH. In using technologies collaboratively, T8 commented, “With collaboration sometimes there is a gap. We’ve got the technologies, but it’s not used to the full”.

Establishing collaborative learning communities is essential for teaching practices following the coming merger of the two deaf education centres and preparing students for a globally interconnected future (Brown et al., 2010; Jeong & Hmelo-Silver, 2016). T7 explained collaboration as follows, “Now it’s more about collaborative teaching. It’s about creative exploration by students to create the work and learning themselves and also do that remotely via video conferencing. That is so great”.

Limitations

Limitations of influences and conditions beyond my control narrowed and defined the scope of my research. While the five limitations I encountered might have impacted my research process, results, findings and conclusions of my study, they supported judgement on the extent to which the findings might be generalised to other

people's situations and research studies. The limitations also created future research opportunities for improving the quality and validity of any further studies (Creswell, 2014). I mitigated the limitations by remaining alert to assumptions and biases, ensuring opportunities for equal representation from both deaf education centres, recognising the challenges of staying neutral, and maintaining an impartial role in line with ethical research practices (Biros, 2018; Parsell et al., 2014).

First, identified limitations of this research included managing the paucity of research on the integration of EET in teachers' pedagogy of students who are DHH. The impact of this dearth of knowledge was that it might limit the scope of the analysis and lead to inaccuracies in my arguments. Also, the lack of research in this field presented a possible increased margin for error in aspects of this research and its methodology. My approach to this limitation and to minimise risk was to source whatever relevant research findings I could locate throughout the duration of my studies.

Second, a further limitation was the use of self-report data from the survey and interviews, which is inherently biased. The impact of my practitioner-based research might have resulted in the advantage of having insider access through my working relationship with the staff of the two deaf education centres. Further, this relationship might have given rise to personal assumptions and biases when making conclusions about my research questions. My approach to the limitation and to minimise risks was that I viewed my relationship with the staff provided the advantage of gaining access to an in-depth understanding of their situation (Creswell & Plano Clark, 2018; Yin, 2018).

A third limitation centred on the limited access to professional learning participants had at the time of my research. This limitation was that most participants' limited use of EET, such as gamification, robotics, augmented reality, and virtual reality limited the results on these technologies' potential (Villagrasa et al., 2014). Participants

had not received opportunities to access professional learning to apply the new dimensions recently added to the technology curriculum, namely the New Zealand Digital Technologies/Hangarau Matihiko Curriculum (New Zealand Ministry of Education, 2017a, 2018a). My approach to this limitation, and to minimise its risk of a situation of limited results on the possible range of technology applications in these participants' pedagogy, was to be inclusive toward the data that was available (New Zealand Ministry of Education, 2007b; New Zealand Ministry of Education, 2017a, 2018a).

Fourth, the situation that data collection (as described in Chapter Three) took place at one point in time, thus creating another limitation. The impact of this limitation was that I had one opportunity to collect data through an online survey and in-person interviews. My approach to this limitation, and means to minimise its risk, were to glean from the information provided me. This data was rich self-report and in-depth insight rather than general first-hand observation data on teaching with technologies (Yin, 2018). Further, the data considers longitudinal progress over multiple stages of time rather than multiple points of time (Cohen et al., 2004; Creswell & Plano Clark, 2018).

A fifth limitation was that there was no differentiation among deaf, hard of hearing or hearing participants. While I took the participants' preference for oral or sign language into consideration, I did not include the impact of their hearing levels on their integration of EET in their pedagogies. My approach to this specific limitation and means to minimise risk regarding this was to recognise that these varying auditory conditions might result in different EET approaches and applications (Yin, 2018).

I next propose five areas for further research.

Proposals for Further Research

Based on the background in Chapter One, the literature review in Chapter Two, my survey and interview data in Chapters Three, Four and Five, I present five fields for potential new research on the integration of EET in the education of students who are DHH. Four of these proposals for further research require investigation to address gaps, theoretical foundations and future practices. These four proposals relate to pedagogy, students and their families/whānau, technologies, and policies and practices. The fifth proposal concerns creating research opportunities to investigate the implementation of online learning for students who are DHH resulting from the Covid-19 lockdown period, which occurred towards the end of my studies.

Pedagogy.

I put forward seven proposals for research in pedagogy that integrates EET. The first proposal is for research to conclude whether students whose first language is sign language or those whose first language is a spoken language require different pedagogy practices. Such research would focus on the integration of EET in learning according to their hearing status. The second proposal is to determine if teachers' hearing status affects how they integrate EET in their pedagogy. Such research would investigate whether teachers who are either deaf, hard of hearing or hearing use technologies in different ways due to their hearing status.

The third proposal calls for an investigation on the significance of strategic leadership and planning of pedagogy to provide access to equitable and ongoing EET within organisations such as the two deaf education centres. Such research would seek to understand the criteria required for the sustained acquisition and maintenance of EET to ensure its purposeful integration in the pedagogy of the staff they lead. The fourth proposal is to investigate the assessment practices that monitor the students' language

development, learning progression and social growth through EET integration. T9 described assessment, “Assessment is putting that reflective practitioner’s hat on. You’re observing, and you’re giving feedback, and you know exactly what your student struggles with”. As assessment of the effect of EET integration on students’ language development, learning progression, and social growth outcomes may be subjective, it requires careful research to avoid such bias.

The fifth proposal is for research to identify assessments that measure and evaluate EET integration on teachers and leadership's educational practices (Dunn et al., 2013; Hora et al., 2014; Pierson & Borthwick, 2010). The sixth proposal concerns a study of teachers’ increased workload resulting from EET integration in pedagogy. All participants referred to the impact that the introduction of technology had on their available time. T2 explained this situation, “I thought the computer would lighten my workload, and things would get easier and easier, but now the workload is all adding up to many additional hours a week”. The seventh research proposal is to encourage the investigation of EET integration in pedagogy during teacher training (Gudmundsdottira & Hatlevik, 2018). During this time, trainee teachers can be introduced to and experiment with integrating the most current EET to bring into their actual teaching practices (Akaslan & Kull, 2017; Hammond et al., 2011; Rawlins & Kehrwald, 2014).

Students and their families/whānau.

Proposal for further research and re-evaluation in the field of students and their families/whānau include a response to the relative paucity of research on the integration of EET in ways that involve the students’ parents, family/whānau, network of supportive people, and the students’ school of attendance. Such research would ascertain and compare different approaches and determine the criteria for an improved environment where all involved can take advantage of the benefits of embracing EET. Such research

would further investigate the support required to integrate EET to extend and enrich the homework, language development, learning progression and social growth of the child concerning the home and school situation. Additionally, valuable potential further research might focus on the students' voices and experiences in gaining access to EET and their use of these to develop their language development, learning progression, and social growth during their schooling.

Technologies.

Proposals for further research in the field of technologies include building on the findings of my research regarding measuring the influence on pedagogy, students' language development, learning progression and social growth through specific hardware, software and apps for each of the learning levels of the curriculum subjects (New Zealand Ministry of Education 2007b, 2017a). Another proposal for further research concerns the investigation and analysis of the integration of educational support provided by assistive amplification technologies (hearing aids, FM systems, cochlear implant equipment, and sound field systems), and individually modified technology hardware such as alternative keyboards, monitors, mice, and speech synthesisers. These specially designed assistive technologies primarily compensate or remediate hearing loss and assist individual students to participate and integrate into the performance of education, communication and play (Lidström & Hemmingson, 2014). Each assistive or modified technology potentially requires in-depth research.

Policies and practices.

Proposals for further research on policies and practices include scrutiny of the application of confidentiality, privacy, copyright, net safety, and cyberbullying (MacFarlane & Mina, 2018). Such research might investigate the synergies or conflict

brought about by existing and new initiatives, policies, practices, governance structures, relationships and partnerships. Such investigation intends to prevent the compounding of vulnerabilities or risks to the student's language development, learning progression and social growth when engaging with EET (Livingstone & Bulger, 2014). Regarding these matters, T7 specified, "The important thing to remember about utilising technology is that you need to make sure that everything is safe for the students to utilise".

Covid-19.

During the last stage of writing my thesis, the Covid-19 pandemic and the ensuing global lockdown to ensure public health through social distancing commenced on Thursday 26th March 2020 in New Zealand. One of the implications of forced isolation was school closure. Global government initiatives provided funding to support distance learning. The overarching strategy was to provide parental guidance to support continued education through televised and online distance learning. (Burgess & Sievertsen, 2020; Viner et al., 2020; Wang, Zhang, Zhao, Zhang, & Jiang, 2020).

Educational initiatives across international education sectors focussed on creating online learning and communication opportunities for students to maintain education and social contact (Arnett, 2020a, 2020b). These initiatives accelerated how EET are used in education to ensure as little interruption in students' learning and assessment. Certain apps and software rapidly became household words. These included Zoom video conferencing (Konrad, 2020; Morgan, 2019) and learning management systems and platforms (Carlson, 2019; Shurygin et al., 2020). Examples of these platforms used by schools included Google Classroom (Heggart & Yoo, 2018), Microsoft Teams (Buchal & Songsoe, 2019; Lansmann et al., 2019), Canvas (Marachi & Quill, 2020), and SeeSaw (Guarino et al., 2020; Johns et al., 2017). This complex situation of utilising EET for learning provided both opportunities and challenges for stakeholders. The impact and

implications of a pandemic-directed learning solution lead to exciting prospects for further research. Of particular interest would be researching the experiences of students who are DHH in these learning circumstances.

Summary of research structure

Figure 31 summarises the structure of my thesis. The upper section of this figure describes my research planning and construction through Chapters One, Two and Three. The lower section indicates the sequence of Chapters Four, Five and Six.

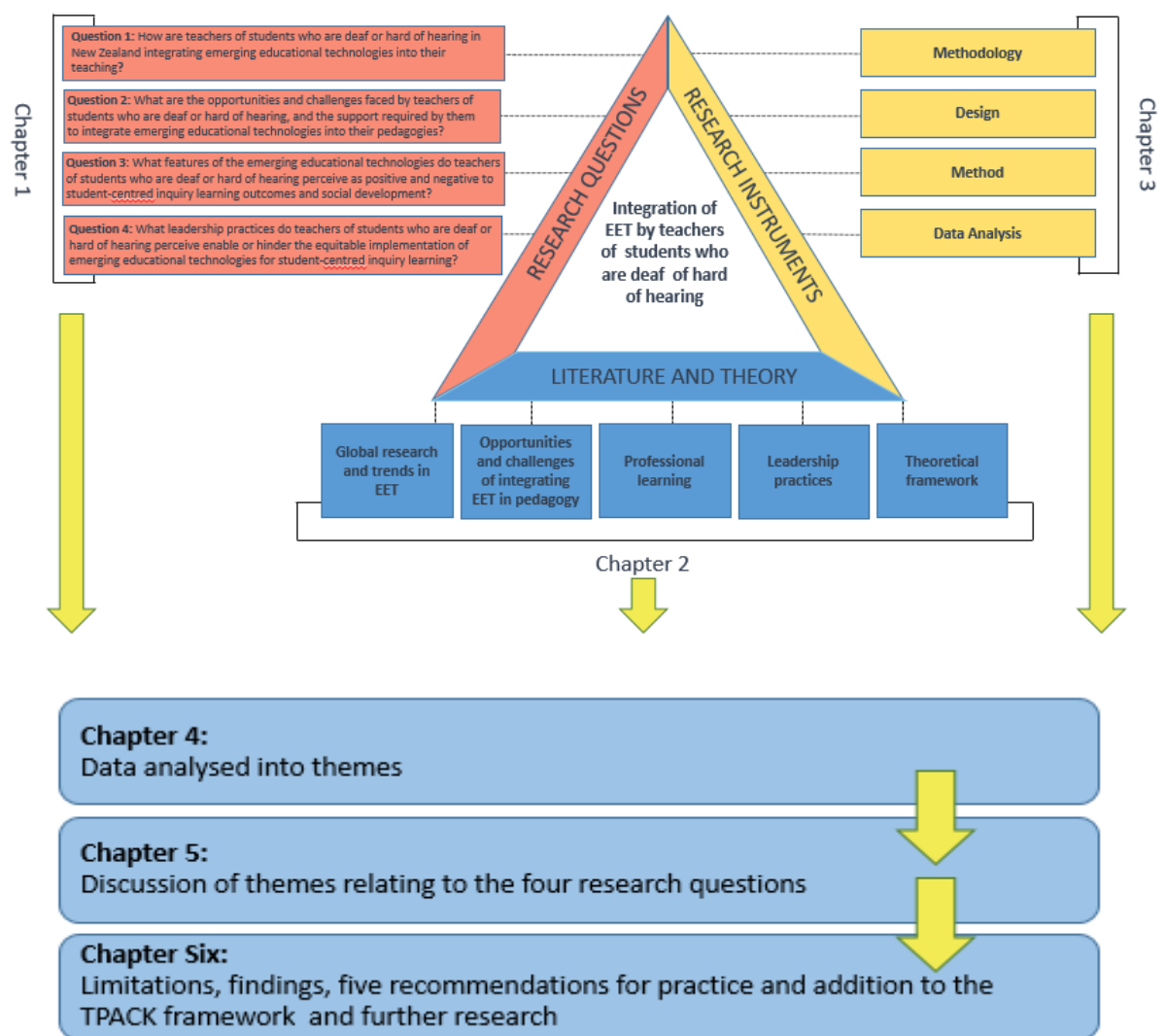


Figure 31. Structure of the thesis on the integration of EET by teachers of students who are DHH in New Zealand.

The introduction and contextual background in Chapter One set the scene for this study. I introduced the four research purposes and four research questions to address and answer the research problem. The literature review in Chapter Two provides an extensive examination and synthesising of literature. Additionally, it offered an exploration of multiple theoretical frameworks to establish those elements that appear essential to this context when teaching students who are DHH. The methodology and methods defined in Chapter Three describe my research plan's development, namely the explorative mixed methods research design for data collection and analysis.

Chapter Four concerned identifying five themes from the participants' data in both the online survey and in-person interviews. I addressed the findings from the analysis relative to answering the four research questions. Tables 9 to 19 illustrated the results of the quantitative and qualitative data concerning the five themes.

Chapter Five presented the discussion following the data analysis. Finally, Chapter Six concludes the findings, recommendations and proposals for further research and offers its contribution towards research on the integration of EET.

Conclusions

This thesis examined literature and data on factors that influence teachers' integration of EET resources and practices in their pedagogy. The study explored the potential positive impact of teachers' integration of EET on their students' language development, learning progression and social growth. As EET change and develop, schools continue to spend money on professional learning to support teachers in becoming competent users. Therefore, research on integrating EET in pedagogy for the students' meaningful, equitable, inclusive and age-related language development, learning progression, and social growth is required.

This thesis, therefore, intended to contribute to and encourage further and future research to address the paucity of literature and provide empirical evidence on the integration of EET in teachers' pedagogy of students who are DHH. I achieved this purpose by examining the New Zealand research participants' views and practices when integrating these technologies into their student-centred inquiry teaching. Further, I investigated research that supported the view that when teachers understand the relevance of EET in their pedagogy, these technologies have the potential to become helpful resources and practices to support, extend and enrich students' language development, learning progression and social growth (Davies, 2010; Webster, 2016). T9's observation captured this view, "Unless you venture out, then you won't learn, because venturing out opens your eyes and you realise, Oh wow, that's brilliant! I could try that with my deaf or hard of hearing learners, or I could probably switch that around to suit my learners".

The investigation of the data results (Chapter Four) and the discussion of my four research questions (Chapter Five) contributed to addressing three additional purposes of this thesis. These purposes were to: identify teachers' perspectives on the role of school leadership for the equitable and meaningful integration of EET in pedagogy; create awareness of the challenges and barriers to integrating EET in teaching and; define the elements and contexts of a theoretical framework to underpin the practice of integrating EET in student-centred inquiry teaching practices.

Regarding a theoretical framework, my study investigated participants' data and the literature for those elements and contexts that may provide an approach to anchor the values, vision, goal and pedagogy of teachers who implement EET when teaching students who are DHH. I focussed on the TPACK framework (Koehler & Mishra, 2009; Koehler et al., 2013) and reflected on the contextual additions required for this

framework to reflect the rapidly changing nature of technology and the specific pedagogy requirements for teachers of students who are DHH.

While this study offered initial insights into teachers' integration of EET in their teaching, far more research is required to understand the role of professional learning and other variables contributing to the greater assimilation of EET in the classroom. Further research is necessary to facilitate a professional learning framework that provides phases and activities to purposefully support the teachers' inclusion of EET into their pedagogy.

Going into the future with a new generation of immersive EET requires flexibility and adaption, which are necessary to thrive in workplaces of the future (Roblyer & Doering, 2014). These skills also include literacy for the digital age, inventive and higher-order thinking, effective communication, and empowering students to attempt feats beyond their current capabilities (Newhouse, 2014). Interpreting my study results suggests that ongoing professional learning, collaborative practices, flexibility in times of change and strategic and empathetic leadership are crucial to implementing EET in pedagogy.

Like researchers who appealed for educational research to address the lack of empirical findings on the integration of EET for language development, learning progression and social growth of students who are DHH, I likewise support the call for research in this field (Beal-Alvares & Cannon, 2014; Kozuh et al., 2014, Kozuh et al., 2015; Valentine & Skelton, 2009). Such research aims to attain language development, learning progression, and social growth opportunities for students who are DHH. My study indicates how far we still need to progress to engage fully in high-quality professional learning and exposure to potentially game-changing EET applications and implications.

If we come together as learners in a community of well-being, kindness and keenness to solve problems and create knowledge in flexible ways, using emerging smart tools to reinforce learning, we can fully embrace the opportunities and challenges of the interconnected world. (Fischetti, 2019, p. 7)

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Appendices

Appendix A - Board approval

Appendix B - Information statement

Appendix C - Online survey questions

Appendix D - Interview questions

Appendix E - Application of hardware, software and apps

Appendix A: Board Approval

Document Type: Approval of Board and Principals for the research student to submit an Ethics Approval Application for teacher participation in two research instruments (Document 1 Version 1)

Research Title: *Integration of Emerging Educational Technologies by Teachers of Students who are Deaf or Hard of Hearing in New Zealand*

Investigators: Doctor Scott Imig (*Chief Investigator and Primary Supervisor*), Professor John Fischetti (*Co-supervisor*), Doctor Jill Duncan (*Co-supervisor*), Hilda Baker (*Higher Degree by Research Student*)



Dr Scott Imig (*Chief Investigator and Primary Supervisor*)
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The Board Chair of the Board of Trustees and the Principals of the Deaf Education Centres in New Zealand:
 Kelston Deaf Education Centre,
 3 Archibald Road, Kelston, Auckland, New Zealand, 0604.
 Phone: +64 (9) 827 7859.
 e-mail: kdec@deafeducation.nz

Van Asch Deaf Education Centre,
 38 Truro Street, Sumner, Christchurch, New Zealand, 8001.
 Phone +64 (3) 326 6009

Dear (*Board Chair*), (*Principal, Kelston Deaf Education Centre*), and
 (*Principal, van Asch Deaf Education Centre*),

Re: Your approval to progress the voluntary online survey and voluntary case study interviews for the research of Hilda Baker titled: *Integration of Emerging Educational Technologies by Teachers of Students who are Deaf or Hard of Hearing in New Zealand*

Hilda Bakers' study, under the supervision of Doctor Scott Imig (*Chief Investigator and Primary Supervisor*), Professor John Fischetti (*Co-supervisor*) and Doctor Jill Duncan (*Co-supervisor*), has progressed to the point where she is in a position to submit an application for ethics

approval the University of Newcastle's Ethics Committee to ensure that ethical standards are adhered to for:

- A voluntary online survey of all the teachers of the two Deaf Education Centres in New Zealand;
- And voluntary interviews with twelve of these teachers who express a keen interest in emerging educational technologies in teaching practices.

Background

Last year Hilda Baker (the research student) applied for and was granted study leave. To date, this time has allowed her to make steady progress on her research. One of the reasons that was stipulated for having study leave is to allow Hilda the time needed to administer the research survey and interviews without it impacting on her workload once back in full-time employment.

Process

1. **Signed approval by the Board of Trustees and Principals** - The research student wishes to provide the Human Research Ethic Committee with your signed approval (see below) for the voluntary survey and voluntary interviews to take place at both Deaf Education Centres during the estimated period of late September to early December 2018;
2. **The Board and Principals to receive an ethics approval number** - Once your approval has been given, the survey and interview questions will be submitted for ethics approval. A dedicated ethics approval number will be issued for this research once it meets ethics requirements. This approval number is for your reference and for you to contact the Chief Investigator or Ethics Committee should there be any need for this.
3. **Signed consent** - Once ethics approval with an ethics approval number has been given, Hilda will provide you with this number and a consent form detailing the implementation of this research. This consent form also needs to be signed by you, and a copy kept for your records.

Should you require further information, please email the research student, Hilda Baker, at hilda.baker@uon.edu.au, or phone 021 179 5312. If you wish to communicate with the Chief Investigator/Primary Supervisor, please contact Doctor Scott Imig: Phone 0061-2-49217956 or e-mail scott.imig@newcastle.edu.au.

Thank you for your attention to the attached approval form.

Document Type: Organisation Approval Form

Research Title: *Integration of Emerging Educational Technologies by Teachers of Students who are Deaf or Hard of Hearing in New Zealand*

Investigators: Doctor Scott Imig (*Chief Investigator and Primary Supervisor*), Professor John Fischetti (*Co-supervisor*), Doctor Jill Duncan (*Co-supervisor*), Hilda Baker (*Higher Degree by Research Student*)



Doctor Scott Imig (*Chief Investigator and Primary Supervisor*)
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APPROVAL FORM

Research title: *Integration of Emerging Educational Technologies by Teachers of Students who are Deaf or Hard of Hearing in New Zealand*

I approve that Hilda Baker (Research Student), under supervision of Doctor Scott Imig (*Chief Investigator and Primary Supervisor*), Professor John Fischetti (*Co-supervisor*) and Doctor Jill Duncan (*Co-supervisor*), may administer the voluntary online survey and conduct the voluntary interviews in the estimated period of late September to early December 2018.

Printed name: _____ Signature: _____ Date: _____
 Board Chair (.....)

Printed name: _____ Signature: _____ Date: _____
 Principal of Kelston Deaf Education Centre (.....)

Printed name: _____ Signature: _____ Date: _____
 Principal of van Asch Deaf Education Centre (.....)

Thank you for your approval.

Doctor Scott Imig (*Chief Investigator and Primary Supervisor*)

Professor John Fischetti (*Co-supervisor*)

Doctor Jill Duncan (*Co-supervisor*)

Hilda Baker (*Research Student*)

Appendix B: Information Statement and Participants' Consent Form**Information Statement**

Dr Scott Imig (*Chief Investigator and Primary Supervisor*)

School of Education,

Faculty of Education and Arts

University of Newcastle

Callaghan 2308, NSW, Australia

Email: scott.imig@newcastle.edu.au

Phone: 0061-2-4921 7956

Link to New Zealand Sign Language translation of this document

Information statement for teachers' participation in an online survey and optional interview related to the integration of emerging educational technologies by teachers of students who are deaf or hard of hearing in New Zealand

You are invited to participate voluntarily in an online survey. This opportunity is followed by an optional interview related to the research project identified above. The research is conducted by Hilda Baker (*Higher Degree Research Student*), under the supervision of Dr Scott Imig (*Chief Investigator and Project Supervisor*), Professor John Fischetti (*Co-supervisor*), and Dr Jill Duncan (*Co-supervisor*) from the Faculty of Education and Arts, University of Newcastle.

What are emerging educational technologies?

Emerging educational technologies include the use of digital processes and resources such as:

- portable digital devices (*e.g. laptops, iPads, mobiles*);
- broadband (*for interaction across distance, in-person learning activities and social engagement*);
- apps (*applications*), software programs that perform a specific function or learning activity for hardware devices and mobile devices such as tablets and smartphones;
- digital games (*for game-based learning*);
- augmented reality (*AR - digitally enhance audio-visual version of reality*);
- virtual reality (*VR - the experience of being in an artificial environment*);
- artificial intelligence (*AI - computer systems that perform tasks, which usually require human intelligence*);
- robotics (*to facilitate students' knowledge, skills and attitudes for the design, analysis, application and operation of robots*);
- data analysis software (*to drive student and instructional decisions*) to supplement, support, and extend student-centred pedagogy and social growth.

Why is the research being done?

The purpose of the research is to study resources and practices of emerging educational technologies, which teachers of students who are deaf or hard of hearing (DHH) use in their teaching to support student learning achievement and social growth. Ideally, this research will provide recommendations for developing practices, supporting teaching pedagogy and encouraging further research.

Who can participate in the research?

1. Online survey – All teachers of both the deaf education centres in New Zealand are invited to participate in the online survey. To access this survey, please click on the electronic link above
2. Optional participation in an interview – The research requires a cohort of 12 teachers who would volunteer to participate in an interview that provides an opportunity for an in-depth discussion of the survey questions. Teachers from either of the two deaf education centres in New Zealand, who have a high interest in the practice of including emerging educational technologies in teaching pedagogy, are invited to participate in a voluntary interview. Please express your interest either by stating this in the online survey comment box or by e-mailing Hilda Baker directly at hilda.baker@uon.edu.au. Should more than 12 teachers volunteer for the interview, a selection process will take place. Teachers showing high engagement in the use of emerging educational technologies in their teaching practices will be selected first. This will be followed by those teachers who have an interest in involving emerging educational technologies in their teaching. Both those selected and those not selected will be notified by e-mail.

What would you be asked to do?

Participate in an online survey - You will be asked to complete the online survey voluntarily. There are 17 questions, which focus on some demographic details, your experiences and integration of various educational technologies and views on professional learning and leadership support needed to sustain your use of emerging educational technologies as a teaching and learning resource.

Participate in an interview – If you have a high interest in the use of emerging educational technologies in teaching pedagogy, you are invited to participate in an interview. You can express your interest in this either by indicating this in the last question of the online survey or by e-mailing Hilda Baker directly at hilda.baker@uon.edu.au. At the end of this online survey, you will be provided with an invitation to participate voluntarily in an interview of about one hour. You will have time to consider your participation in this interview (either in-person or through Zoom video conferencing) during the period that you receive e-mail notification of the survey and during the two week period that the online survey is running. The interview consists of nine questions relating to your experiences of the influence of emerging educational technologies on your teaching practices. These questions will focus on the variables that both help and hinder the implementation of emerging educational technologies in your teaching practices. The interview will be recorded (written and audio or video) and will be conducted in either English or New Zealand Sign Language. Hilda Baker, under the supervision of her supervisors, will conduct the interview. The interview will be held either in-person or via Zoom video conferencing at a location and time that fits in with the interviewees work

circumstances. Teachers who participate in the interview will have the opportunity to read through their transcript to confirm accuracy before data is compiled. These teachers will also receive a copy of the executive summary of the research that goes to the Board of Trustees.

How much time will it take?

- The online survey (link above) takes about 25 minutes to complete.
- The interview takes about one hour to complete.

What choice do you have in the survey? interview?

Participation is entirely your choice.

What choice do you have in the interview?

Only those teachers who give their informed consent will be interviewed. Whether or not you decide to participate, your decision will not disadvantage you. If you do decide to participate, you may withdraw from the interview at any time before submitting your completed interview. You have the option of withdrawing any data, which could identify you.

What are the risks and benefits of participating in the online survey and interview?

Risks: There are no anticipated risks associated with participating in this online survey nor interview.

Benefits: While there are no expected personal benefits, the findings may benefit your teaching practices and the national implementation of emerging educational technologies for teaching students who are DHH. By participating in this interview, you will have the opportunity to reflect on your personal experience/views and share your views on teachers' integration of emerging educational technologies in pedagogy for the education of students who are DHH. The feedback you provide may contribute to the available research literature on the subject and help improve the current service offered by providing new thinking and encouraging future professional learning and research opportunities. Participants will be offered a summary of the results approximately six months after the survey and 12 interviews have taken place.

How will your privacy be protected?

Online survey: Privacy and Security policy of SurveyMonkey:

SurveyMonkey (<https://www.surveymonkey.com/mp/legal/privacy-policy/>) has a dedicated Trust & Security organisation that focusses on application, network and system security and uses transport layer security (TLS) cryptographic protocols to provide confidentiality, data integrity and authentication.

Interview: For the sake of confidentiality, the Board and Principals will have no knowledge of which teachers consent to participate in the research. All information collected through the 12 interviews will be kept confidential. Participants' names will not be released in any report of the project. Names will be replaced with a numerical code when the recordings are transcribed. References to people and organisations will be blanked out to ensure confidentiality. You will be offered the opportunity to review, edit, or erase your contributions. Any information that might identify you will be stored securely and only accessed by the project supervisor and the research student.

Online survey and interview: Data will be retained for at least five years on the University of Newcastle's ownCloud secure server. Hard copies of interview data will be stored in a locked filing cabinet in the Chief Investigator's office. Audio recordings will be stored on the University of Newcastle's own Cloud secure server. Data will be securely destroyed in line with UON policy provisions. At least one copy of the data used for analysis is to be held at the University of Newcastle.

How will the information collected be used?

The collected data will contribute towards Hilda Baker's PhD thesis and may be presented in academic publications, journals or conferences. The data from the interviews will be transcribed by Hilda Baker. Each interviewee will have the opportunity to review the transcribed notes to edit or erase contributions. Non-identifiable data may also be shared with other parties to encourage scientific scrutiny and to contribute to further research and public knowledge, or as required by law. Individual participants will not be named or identified in any reports arising from the project, although individual anonymous responses may be quoted. A report of the interviews will be provided to the University of Newcastle, the Board of Trustees and Principals of Kelston Deaf Education Centre and van Asch Deaf Education Centre. Participants will be offered a summary of the results with a New Zealand Sign Language translation, potentially six months after completion of the 12 interviews.

What do you need to do to participate?

Please read this *Information Statement* and be sure you understand its contents before you consent to participate. If there is anything you do not understand, or you have questions about, please contact the researcher, Hilda Baker.

Online survey: The completion and submission of the voluntary online survey will be taken as your implied consent to participate.

Interview: If you wish to participate in the interview, please indicate this in Question 19 of the online survey or e-mail your expression of interest to Hilda Baker (hilda.baker@uon.edu.au). Once the 12

teachers for interviewing are determined, you will receive a consent form and the interview questions. Please complete and return the consent form. The completion and submission/return of the consent form will be taken as your implied consent to participate in the interview.

Further information

If you would like further information, please contact Hilda Baker at hilda.baker@uon.edu.au. Hilda is also available to meet in person or on Zoom video conferencing if you prefer to ask questions in person.

Thank you for considering this invitation.

Chief Investigator/Primary Supervisor (Name): Doctor Scott Imig.

Signature:

Date: 15 October 2018

Higher Degree Research Student (Name): Hilda Baker.

Signature:

Date: 15 October 2018

Complaints about this research

This project has been approved by the University's Human Research Ethics Committee, Approval No. H-2018-0375. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Services, NIER Precinct, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone add the international dialling prefix to the telephone number +61-2-49216333, email Human-Ethics@newcastle.edu.au.

Consent form

THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

Dr Scott Imig (*Chief Investigator and Project Supervisor*)
School of Education,
Faculty of Education and Arts
University of Newcastle
Callaghan 2308, NSW, Australia
Email: scott.imig@newcastle.edu.au
Phone: 0061-2-4921 7956

Re: Consent Form for interview participation in the research: *Integration of Emerging Educational Technologies by Teachers of Students who are Deaf or Hard of Hearing in New Zealand*

Names of researchers: Dr Scott Imig (*Chief Investigator and Primary Supervisor*), Hilda Baker (*Higher Degree Research Student*), Professor John Fischetti (*Co-supervisor*), Dr Jill Duncan (*Co-supervisor*).

I agree to participate in the interview for the above research project and give my consent freely.

I understand that the interview will be conducted as described in the *Participant Information Statement*, a copy of which I have retained.

I understand that I can withdraw from the interview at any time and do not have to give any reason for withdrawing.

I consent to:

- Participate in an interview of approximately an hour;
- Having the interview recorded (written, audio and/or video);
- Having data extracted from the interview questions to be used anonymously for the research.

I understand that my personal information will remain confidential to the researchers in accordance with the requirements set out by the university ethics committee.

I have had the opportunity to have questions answered to my satisfaction.

I have an option to receive a copy of the study results.

Name of participant (printed): _____ Signature of participant: _____

Date: _____

Contact Details *(to arrange for time and location of interview):*

E-mail address: _____

Phone number: _____

Appendix C: Online Survey Questions**Online Survey**

The implementation of emerging educational technologies by teachers of students who are deaf/hard of hearing (DHH) at Kelston Deaf Education Centre and van Asch Deaf Education Centre

About this survey: Hilda Baker (Resource Manager at Kelston Deaf Education Centre), with endorsement from the Combined Board of Trustees and the ethics committee of the University of Newcastle, is conducting this survey to gain current perspectives and understandings on:

- The integration, opportunities and challenges of including educational technologies to support and extend teaching;
- The perceived effectiveness or not of including educational technology practices to support student learning achievement and psychosocial development;
- Leadership practices to support educational technology inclusion in teaching practices.

This national New Zealand survey offers an opportunity to all teachers of students who are D/HH (from Pre-school, Y1-13, and Transition) at the two Deaf Education Centres to provide feedback on their experience of their implementation of emerging educational technologies in their teaching practices. Educational technology is the use of technology processes and resources such as hardware, software and Internet connection to supplement, support and extend learner-centred pedagogies. The purpose of including emerging educational technologies is to facilitate improved performance in student language acquisition, learning and social development by creating, using and managing the appropriate technologies (Richey, 2008).

The survey should take approximately 20 minutes to complete. Guidelines for answering the questions are in italics. Most questions are answered by marking the most appropriate answer. When you have completed the survey, please click the submit button. If in doubt about any aspect of the survey, or if you would like more information about it or the study, please e-mail Hilda Baker: hilda.baker@deafeducation.nz

Confidentiality: All information collected for this study will receive confidential treatment. While results will be made known to the University of Newcastle and the Board of Trustees, you are assured that no staff member will be identified in any report resulting from the study. While strongly encouraged to participate, this is voluntary, which means that you are free to choose to participate or not, or you may withdraw participation at any time.

Your time to complete this questionnaire is greatly appreciated as your professional experience and opinion are crucial to understanding the current educational technology practices in the education of students who are D/HH in meeting the objectives of the Board's strategic plan.

Thank you for your participation.

1. My current teaching position

Preschool	Teacher in a DHH provision attached to a regular school	Resource Teacher of the Deaf (RTD)	Transition

2. Gender

Male	Female	Other

3. I did my teaching qualification during this period

Before 1997	1997 - 2002	2003 - 2007	2008 - 2012	2013 - 2017	2018 – Currently completing my teachers' qualification

4. I did my qualification as a teacher for students who are DHH during this period

Before 1997	1997 - 2002	2003 - 2007	2008 - 2012	2013 - 2017	2018 – My teacher of DHH students' education is currently in progress	My teacher of DHH students' training has not yet commenced

5. In the box below, enter up to eight apps and/or software programs that you use most frequently in your teaching practices

(Type in up to five apps you most frequently use in your teaching practices)

--

6. My experience in each of these emerging educational technologies

	Non-user <i>(No experience with this emerging educational technology)</i>		Beginner <i>(Can perform basic functions but still require regular help)</i>	Regular user <i>(Familiar and competent with this emerging educational technology)</i>	Advanced <i>(Use and adapt this technology competently, proficiently and creatively)</i>
Portable digital devices					
Broadband for students to interact across distance					
Digital games					

Augmented reality					
Artificial Intelligence (AI) <i>e.g. Alexa, Cortana, Siri, Chatbots</i>					
Virtual reality					
Robotics					
Data analysis software					

7. I have integrated the following emerging educational technologies into my teaching practices for a certain number of years

	Never	This is my first year	1-5 years	6 – 10 years	More than ten years
Portable digital devices					
Broadband for students to interact across distance					
Digital games					
Augmented reality					
Artificial Intelligence (AI) <i>e.g. Alexa, Cortana, Siri, Chatbots</i>					
Virtual reality					
Robotics					
Data analysis software					

8. Access to emerging educational technologies at the deaf education centre where I teach

		No access or use	Use infrequently	Use weekly	Use all the time
1.	My students' access to educational technologies at the deaf education centre where I teach.				
2.	My access, as a teacher, to emerging educational technologies at the deaf education centre where I teach.				

3.	My access, as a teacher, to technology support personnel at the deaf education centre where I teach.				
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9. During a typical school week, I use educational technologies in my professional role in the following ways

		Never	Quarterly	Monthly	Weekly	Daily
1.	For instructional purposes (e.g. teach students, either as a complete class or in groups or one on one.)					
2.	Planning and preparation (e.g. for lessons.)					
3.	Communication (e.g. other teachers, students, parents, stakeholder.)					
4.	Administrative/organisational duties (e.g. related to my teaching.)					
5.	Student assessment and data analysis (e.g. to evaluate and inform my teaching practices and outcomes.)					
6.	Recreationally (e.g. for students to play games, as a reward for completing work or good behaviour.)					
7.	Creatively (e.g. to express and expand student learning.)					

10. Indicate the professional development on emerging educational technologies that you have participated in.

	Not applicable	One-off	Once or twice a year	Quarterly	Monthly	Weekly	Daily
Courses/workshops on educational technology.							
Education conferences or seminars where teachers /researchers present their research findings on educational technology.							
Qualification studies in educational technology.							
Observation visits to other schools regarding educational technology.							
Participation in a network of teachers specifically for the professional development of teachers in educational technology.							
Individual or collaborative research							

on a topic related to educational technology.							
Mentoring/peer observation/coaching on educational technology, as part of a formal Centre wide arrangement.							

11. Comments I wish to bring to attention regarding the professional development of emerging educational technologies in my teaching practices.

--

12. Impact of the professional development in emerging educational technologies on my teaching practices

	Not applicable	Negative impact	No impact	Impact	Large impact
Courses/Workshops					
Conferences/Seminars					
Qualification/s in emerging educational technology					
Observations/visits to other teachers, followed by a discussion regarding their implementation of emerging educational technologies					
Participation in a network of educators on the topic of emerging educational technologies					
Individual or collaborative research on a topic related to emerging educational technology/Centre-wide professional learning to explain a specific emerging educational technology					

13. I engage in the following informal emerging educational technologies professional development opportunities

	Never	Quarterly	Monthly	Weekly	Daily
Read professional information (e.g. research journals, books, magazines, website on emerging educational technologies)					
Informal dialogue (e.g. with my colleagues on how to improve my emerging educational technology practices)					
Exchange emerging educational technology teaching resource (e.g. with my colleagues)					
Joint teaching activities (e.g. combining two classes or involving a student in a distant location to share knowledge/understanding of emerging educational technologies)					

14. As of today, I would rate my satisfaction in how I include emerging educational technologies in my teaching pedagogies of the New Zealand Curriculum as:

Unsatisfied	
Somewhat satisfied	
Satisfied	
Very satisfied	

15. In my opinion, one or more educational leader/s (e.g. principal, and/or my manager, lead teacher, senior teacher or teacher from an e-learning interest group) annually contribute to my professional implementation of emerging educational technologies through various ways of engagement with these technologies.

	Never	Quarterly	Monthly	Weekly	Daily
Discussion (on educational technology goals)					
Classroom observation (of emerging educational technology in teaching practices)					
One-to-one discussion (on problems relating to emerging educational technologies)					
Acknowledging individual effort (related to implementing emerging educational technologies)					
Supporting teachers to obtain dedicated emerging educational technology (where a specific DHH student may require this)					

- 16. Educational leaders (e.g. the principal, management, lead teacher, senior teacher or teachers from an e-learning interest group) can contribute to the bigger picture of including educational technologies in teaching practices each school year. In my experience, one or more educational leaders currently:**

	Never	Quarterly	Monthly	Weekly	Daily
Ensure that teachers work according to the emerging educational technologies strategic goals set out in the Board Charter					
Contribute to the collaborative development of pedagogies that include emerging educational technologies					
Direct teachers to those goals and practices which support new learning and social development opportunities through emerging educational technologies					
Apply common standards of evaluation when including emerging educational technologies for assessing student progress					

- 17. If you have comments on your views, ratings and experiences of emerging educational technologies not stated in this survey, please feel free to address these in the box below.**

**Invitation to participate in an interview
on emerging educational technologies in teaching practices**

Following this online survey, there is an opportunity to participate in an interview of approximately an hour on teachers' integration of emerging educational technologies in their teaching practices.

This interview will be face-to-face at a location, date and time that is convenient to you.

Your participation in an interview will be much valued as it will allow for more in-depth views on your perspectives of emerging educational technologies in your teaching practices.

Please e-mail me (hilda.baker@uon.edu.au) to indicate your interest in participating in the interview related to your use of emerging educational technologies in education.

Thank you for your participation.
The Research Team

Appendix D: Interview Questions**Interview Questions**

(Document 4c Version 1 Dated 03/09/2018)

The date, time and location of the interview will be set up in consultation with you

Topic: Integration of Emerging Educational Technologies (EET) by Teachers of Students who are Deaf or Hard of Hearing in New Zealand

(In all your responses, please discuss your view on what makes integrating emerging educational technologies in your teaching of the curriculum to students who are deaf or hard of hearing different from that applied in regular education.)

General background to your integration of emerging educational technologies for the learning achievement and social growth of students who are DHH

1. Discuss your journey in applying EET to your teaching practices from your earliest introduction until the present. *(This discussion may include: how you view the use of EET in the education of students who are DHH; how you have used/not used specific emerging educational technologies in your teaching of students who are DHH; and how your application of emerging educational technologies differs from that of a regular teacher).*

2. Define the professional learning opportunities in EET that are most significant for your teaching practices with students who are DHH. Explain why these professional learning opportunities were of significance to you.
3. Describe instances where EET have either supported or hindered your teaching of the curriculum to students who are DHH.

Outcomes of the implementation of emerging educational technologies

4. Discuss assessment practices you use to understand the influence of various EET in your teaching practices.
5. What are the opportunities and challenges, in your experience, that have helped and/or hindered you in achieving an ongoing and sustainable approach to including EET in your teaching practices?

Influences when including EET in the teaching of students who are DHH

Communication

6. Discuss communication strategies that support the use of EET in your teaching practices.

Change

7. Give examples of how you accommodate changes caused by introducing new technologies and the consequent new or adapted teaching practices that these require.

Collaboration

8. Please provide examples of how you have used collaborative teaching practices with your colleagues when implementing EET in your teaching.

Leadership, management and budget

9. Describe the leadership capacities, management, and budgetary initiatives you consider essential for the purposeful implementation of EET in teaching practices for students who are DHH.

Appendix E: Application of Hardware, Software and Apps

The appendix below consists of three tables: Digital hardware for the education of students who are DHH; Digital software and Internet platforms for the education of students who are DHH; Specifically mentioned apps for the education of students who are DHH. These tables collectively reference all the hardware, software and apps (in alphabetical sequence) that participants mentioned in the online survey and during the interviews.

The first column of the three tables names the EET. The second column captures participants' data on the benefit of using the hardware, software/Internet or apps in pedagogy. Teachers use the EET to support their students' listening skills, language development, learning achievements in reading, writing, general and content knowledge, mathematical concepts, and skills for social growth. Participants further used EET for assessment purposes.

Three tables to indicate the application and benefits of digital hardware, software and apps in pedagogy for the language development, learning progression and social growth of students who are DHH.

Table 1 *Digital Hardware for the Education of Students who are DHH*

1. Digital hardware for the education for students who are DHH	Application in pedagogy
Computer, Laptops, Chromebook	For finding and sourcing pictures, photographs and videos as these are so powerful and support the context of my teaching (T5). As laptops improve, they become more and more useful and engaging (T2). The information is instantaneously available (T5).
Digital cameras Video cameras	Make photos to create learning stories. Parents can download these photos and the learning stories, for example, from the Educa website (T3). Record actual experiences visually. Parental involvement occurs through sharing the photos (T3).
Smartboard	Can be applied in a variety of way. Kids can draw on it, and it can be used for playing songs and rhymes in sign language and Te Reo sing-a-long video clips. A large number of kids can access the information at the same time (T3). Supports the teachable moment (T3). Pre-school children can sing and dance to the video projected through the smartboard (T3).

Smartphone	<p>As a resource teacher for the deaf, I'm often working on a 1 to 1 basis, and so I can have really good control over how educational technology is used. I'm very much in control of what we use and how long we use it for (T1).</p> <p>I use my smartphone to find out what I need to know about language, syntax, technologies (T2).</p> <p>Just the fact that it's so visual and so hands-on makes it so appealing with our students who have a hearing loss (T1).</p> <p>By giving them a picture of whatever it is that they are not sure about all of a sudden, they know exactly what it is that they're learning about. Visual pictures are just absolutely invaluable for them (T1).</p> <p>Both teacher and students learn (T2).</p>
Tablet/iPad	<p>I use my tablet and phone for recording audio samples. From the recording, I transcribe their recorded verbal/oral language, and it's also possible to record sign language (T5).</p> <p>Not practical for a group if there is only one iPad (T3).</p> <p>Predictive words work because they know what word they want to use, but they're really struggling to sound it out because they're not necessarily hearing all the sounds. This means they're not learning spelling skills, but if that is not the focus, it doesn't matter. They're learning how to get the words to actually get what they want to say out. So it's still showing that they're an author, and they've got a voice, and they've got something to say (T14).</p> <p>Promotes engagement with language and reading (T3).</p>
Virtual reality hardware and three-dimensional glasses	<p>Provides three-dimensional visual experiences of things, places and animals in its entirety in three-dimensional space (T7).</p>

Table 2 *Digital Software and Internet Platforms for the Education of Students who are DHH*

2. Digital software and Internet platforms for the education of students who are DHH	Pedagogical application for learning achievement and/or social growth
Blogs: <ul style="list-style-type: none"> • Kid's Blog • Blogger • Blogspot.com • Acorn to Oak 	<p>For our teacher registration and our appraisal, we need to keep evidence, so we keep that information on a blog. For this, I use my iPad. If I have a PD session, I'll take a photograph of whatever it is that we're attending and add that to make a new post on my blog and add that to it. So I use my iPad or my laptop for my ongoing blog entries (T2).</p> <p>To publish students' work and provide peer/teacher feedback (T2).</p> <p>Supports the students writing, building on the use of vocabulary and grammar, and spoken/signed communication (T2).</p> <p>(Akdag & Özkan, 2017; Krish, Ming, Wah, Nambiar, & Ya'acob, 2012; Speranza, 2015)</p>
Captioned media for curriculum access	Literacy benefits of captioned media for curriculum access (Visiting researcher Anne McGrath Sydney Catholic School, Sydney, Australia 2016).
Data programs	Use that data analysis to analyse the keywords – what words are being used, what kind of syntax is being used (T2).
Educational websites	Use this for parents to access students learning stories and photos. Also, use this as my teacher portfolio for record and to collate evidence and to graph this according to the registered teachers' indicators (T3).
e-mails, texts, phone calls	<p>Supports understanding of what is being spoken about (Filippone & Survinski, 2016; Hochbein, 2020).</p> <p>Sharing with parents regarding timeframes of students' exams (T1).</p> <p>To keep records of these conversation, I prefer to do most of my communicating by email. Even if I do make a phone call, I follow it up with an email just to reiterate what we've discussed. So now I've got a</p>

	<p>paper trail of what's been talked about because I can see how easily you could forget where we were at and how easily things could be misinterpreted or miscommunicated if it's only via telephone. Now I know that there is definitely room for miscommunication via email as well because things can be misread or misinterpreted, but at least you've got that to refer back to, so that's how I like to operate by doing most of my communication via email or text so that there is a paper trail (T1).</p>
Google Classroom	A place for students to upload information and place their final writings (T9).
Google Docs (Shared docs)	<p>Obviously, things like our meeting minutes are recorded, and they're all there. We are able to share Google Docs with each other and add to them as we go, and all have access to them. It just makes life so much easier (T1).</p> <p>I often have students write a document, share it with me, then I can access the doc and highlight any errors etc., for them to edit (T8).</p>
Google Drive and Google Apps	<p>Google is very suited to the high school students who are deaf or hard of hearing on my caseload. I use it because all the schools use Google and Google Docs. I use that a lot with them for sharing information with me about their assessments and assignments. Sharing is really valuable. I can give them feedback on grammar and make suggestions (T1).</p> <p>Google Drive is great for collaboration (T2).</p> <p>To write a letter or do an article or do research and put pictures in their projects and presentation of their slideshow (T8).</p>
Google Maps	To provide visual information on places that the students have not heard of before or are unfamiliar with (T1).
Google Sheets	To collect data (T1).
Google Slides	Useful for presentations, for example, students' own inquiry topics (T8).
KAMAR	A student database that is gradually being rolled out for teacher use.

Microsoft Office 365 / Microsoft TEAMS	<p>Recording in TEAMS helps in keeping tabs on where things are at. Through TEAMS, we can share information so easily. It's just a great way of working. In fact, I have access to other Teams conversations, and so I can read those and learn from the information that's up there (T1).</p> <p>Allows for really good collaborative communication (T2).</p> <p>(Buchal & Songsore, 2019; Lansmann, Schallenmuller, & Rigby, 2019)</p>
PowerPoint	(Konstantinidis, Theodosiadou, Papachatzi, & Pappos, 2017; Pros et al., 2013)
Games	<p>I actually selected that particular topic of Gamification. Students love gaming online. However, I needed to find out how that could be beneficial because there is learning gamification, for example, Mind Craft. There are many useful educational avenues that you can go down with students utilizing that particular game. You can incorporate science. You can create volcanoes within Mind Craft, and you can do mining within Mind Craft. So there's a number of subjects of the curriculum that are covered by gamification. They can create their own game, so that's also within e-learning as well (T7).</p>
TED Talks	Support high school students in their research (T2).
Virtual reality and augmented reality software	These provide tools for three-dimensional learning experiences (T7).
YouTube, films, e.g. from Netflix and video clips (Subtitles are required)	<p>To provide visual information that the students have not heard of before or are unfamiliar with (T1).</p> <p>Understanding of what is being spoken about (T2). The technology is very visual, which therefore lends itself to videos in sign language (T3).</p> <p>Provide good documentaries with captions (T12).</p>
World Wide Web (the Web)	A source of knowledge exploration (T10).
Zoom video conferencing	<p>Zoom is invaluable for setting up a little chat room between the students (T1).</p> <p>Invaluable for accessing the national connections (T1).</p> <p>(Konrad, 2020; Hani; 2019)</p>

Table 3 *Specifically Mentioned Apps for the Education of Students who are DHH*

3. Specifically mentioned apps for the education of students who are DHH	Pedagogical application for learning achievement and/or social growth (Leinonen, Keune, Veermans, & Toikkanen, 2016)
ABclicks	For practising listening with background noise. So this app creates background noise, and you can increase the volume of it and change the amount of background noise (T1).
Apps and software for assessment	Apps and software for assessment included blogging (Akdag & Özkan, 2017; Krish, Ming, Wah, Nambiar, & Ya'acob, 2012; Speranza, 2015), Book Creator (Kemp, 2020) and e-Portfolios, which provide a means of assembling images and narratives to represent the progress of personalised learning (Haralabous & Darra, 2019; Hooker, 2019). Other apps and software for assessment included Explain Everything (Taaffe, 2016), Google Docs, Hear Builder, Kahoot, KAMAR Student Management System, Kids Blog, Phonics Apps, Photo Gallery, Poplet, Stop Motion video animation app and TinyWords. A few participants used software with rubrics to measure, chart growth, provide instant feedback and self-evaluate through accomplishing specific tasks and processes (Terrell, 2019; Wise, 2016).
Aurasma	To combine NZSL videos with reading books (T7).
Book Creator	Helps students write their own books. It's a great one for sharing with families (T1).
Communication skills games: Talk Town	Talk Town utilises the strengths of students who are deaf or hard of hearing to improve their self-advocacy, communication abilities and social skills. It aims to remove barriers to friendship that may cause loneliness for these students. The game allows them to practice communication and engaging with others in a safe and fun way. The Talk Town app is a great concept, and I encourage teachers to give it a go – see how you could use it with your students, as well as with their peers, keeping in mind that nothing will replace real people interactions, but if an app can help make it easier then by all means (T12).

Eggy Words 250	Helps students to learn and recognise sight words (T2).
Explain everything	To create resources and how-to tutorials (T7).
Kahoot	An app that allows teachers to create quizzes, multiple-choice interactive questions, discussions and surveys. Kahoot can be created and used for various aspects of inquiry and learning. Team options allow the students to work collaboratively (T7).
Fun with Directions	This works up in levels, and so the length of the instruction gets longer as they [the students] get more able.
Listening games: HearBuilder	For younger students, HearBuilder works up in levels, and it keeps a very accurate record of the level of where they're at. That's a really good way of keeping tabs on the progress that they're making (T1). For phonics and sequential learning (T4). Improves auditory memory for students who are hard of hearing (T4).
Maths games apps: I Can Count Money.	For maths, we use apps for maths games that I know how to play. I like to work in a team for those sorts of things. So we have the iPad together, and there are questions that come up which you have to answer. It gets shared around, and it's a competition to see who actually gets the answer first. That's really good to encourage students to work together and also to learn those facts. Sometimes I use videos that have sign language. I Can Count Money supports a student who struggles with the concept of money. I Can Count Money. That is a New Zealand made app, so it uses New Zealand money. Within that app, there are a lot of little mini activities (T1). Language-based videos in BSL have got lots of video stories. These are really good for the students to see the signs on the screen (T8).
Memory game apps	Apps with memory games to support memory, recall and sequence. These are great for younger students for scaffolding and recall memory (T12).

New Zealand Sign Language Dictionary app	The diagrams and videos are really helpful to support the learning of New Zealand Sign Language (T1).
Padlet and similar apps for collaboration	For a visual concept web. Provides a visual plan (T7). Students communicate with each other through the Padlet page. (Fisher, 2017; Leinonen, Keune, Veermans, & Toikkanen, 2016; Wright, 2017).
Play Home	Use those a lot for auditory memory because they're really visual and interactive. So I can use those for giving them two or three items for auditory memory tasks, and they've got to carry that out on their iPad, which they really enjoy doing (T1).
Phonetic Vowels	Supports the students' learning of phonetic vowel sounds and letter combinations.
Reading Apps:	I use technology is for reading in New Zealand Sign Language with the iPad (T8).
<ul style="list-style-type: none"> eBook app from the Ministry of Education for English and New Zealand Sign Language 	<p>I found technology really handy for reading. This means we've got a whole library of books in one place on the iPad, so I don't need to have a whole library of books in my classroom (T14).</p> <p>There are so many apps that can use depending on the students' learning needs and hearing levels. Apps support specific individual education plan goals. I can set it for my students to what things interest them. I can set it to an age that I want the student to be reading at. This means that the students can do stuff with me, and they can also do stuff on their own (T14).</p> <p>Sally Possum for language development (T8).</p>
<ul style="list-style-type: none"> Epic online browser app 	
<ul style="list-style-type: none"> PM Benchmark online app 	
<ul style="list-style-type: none"> Ready to Read series online 	Access for New Zealand Sign Language students to reading and stories in New Zealand Sign Language and English (T8).
<ul style="list-style-type: none"> Sally and Possum' (Australian Auslan/literacy app.) 	Online books can meet varying levels and age groups. They're all high-interest books with clear pictures and are really exciting (T14).
<ul style="list-style-type: none"> Sunshine Classics 	

Rhyme With Sign	<p>The young ones love to see nursery rhymes in sign language (T1).</p> <p>I use the app a lot, especially when I'm going into classes around using New Zealand Sign Language week to teach them sign language (T1).</p>
SeeSaw	For connecting with students (T7).
Semantic maps	<p>Engage in and build vocabulary at their reading age and to support forward progress from their current level (T2).</p> <p>Ensure understanding and scaffolding of high-frequency words (T2).</p> <p>Build on student interest (T2).</p>
ShowMe (an open online learning community where anyone can learn and teach any topic)	<p>Apps like ShowMe are really good because I can do a task with the students and record the task being done. ShowMe has audio and video suitable for audio and signing situations (T14). ShowMe allows the student to go back and do things on their own, and if they're unsure of what to do, they can look back at the app rather than coming back to me every time. They can revisit that learning so easily (T14).</p>
Thinglink	Makes images interactive by adding notes and videos (T7).
Touchcast	To produce 'green screen' video news items (T10).
Writing Apps	To support the development of fine motor skills and the art of writing (T4).

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