300061394

An Investigation and Evaluation of how Wellington City Libraries incorporate STEAM Education into Children and Youth services and programmes.

by

Kate McLachlan

Submitted to the School of Information Management,
Victoria University of Wellington
in partial fulfilment of the requirements for the degree of
Master of Information Studies

October 2019

300061394

VICTORIA UNIVERSITY OF WELLINGTON
School of Information Management

Master of Information Studies

IMPORTANT DISCLAIMER

with respect to a MIS Research Project (INFO 580)

An Investigation and Evaluation of how Wellington City Libraries incorporate STEAM Education into Children and Youth services and programmes.

(Thereafter referred to as 'The MIS Research Project')

being undertaken by

Kate McLachlan

in partial fulfilment of the requirements of the degree of
Master of Information Studies,
School of Information Management, Victoria University of Wellington.

Topic Commencement: **Date October 2019**

1. Victoria University of Wellington and its Council, its members, staff, employees, students and agents undertake no duty of care in contract, tort, or otherwise, to users (whether direct or indirect) of the MIS Research Project and make no warranties or representations of any kind whatsoever in relation to any of its contents.

2. The MIS Research Project is only made available on the basis that all users of it, whether direct or indirect, must take appropriate legal or other expert advice in relation to their own circumstances and must rely solely on their own judgement and such legal or other expert advice.

3. Under no circumstances will Victoria University of Wellington and its Council, its members, staff, employees, students or agents be liable in any way whatsoever, whether in contract, tort (including negligence), for breach of any statutory or regulatory duty (to the fullest extent permissible by law), or otherwise, to any user (whether direct or indirect) of the MIS Research Project for any loss or damage whatsoever arising directly or indirectly as a result of the use in any way of the MIS Research Project.

4. Each exclusion in the clauses of this disclaimer and each protection given by it is to be construed as a separate exclusion applying and surviving even if for any

reason any of the exclusions or protections are held inapplicable in any circumstance.

Abstract.

Research statement: This study investigates and analyses the perspective of Children and Young Adult (CYA), librarians on their experiences and opinions of STEAM learning incorporated within CYA services and programmes, for children. The outcome of this research will provide better knowledge and understanding of how New Zealand Public Library STEAM services and programmes can be improved, focusing on further development of STEAM and library policies, practice and services to encourage more library users, (children and their parents) to develop the knowledge and skills vital to their growth and contribution in the global work economy.

Methodology: This research was a qualitative study that used a phenomenological methodology. Seven librarians, who work in STEAM and children's services from four public library networks in Wellington, participated. Face to face interviews were conducted to collect data.

Results: The findings of this study revealed there have long been some elements of STEAM present in existing WCL children and youth services (CYA) such as preschool storytime, Baby Rock and Rhyme and school holiday programmes. Despite making significant advances in their CYA services by introducing robotics, technology; arts and crafts and Lego as a method of incorporating STEAM into their CYA services, STEAM services are still in the experimental stage and require further planning and development, especially in the areas of formal structure and content of programmes. WCL has been delivering unique STEAM themed programmes and events after school, during school holidays and school visits that have been successful through attendance and engagement from children. Results from the interviews and literature suggest STEAM services for children are another platform through which children, as well as their families, schools and various communities.

Implications: The findings of this study will be of interest to librarians and public libraries that work in children and youth services and want to develop improved programmes and services that more effectively meet the information needs of children in learning STEAM education.

Keywords: STEAM, STEM, librarians, public libraries, information need, education, Children and Youth, services and programmes, and evaluation.

Acknowledgements.

I would like to thank my supervisor, Anne Goulding, for her support, advice, guidance, and patience throughout the duration of this research project.

I would like to thank all my work colleagues for participating in this research project, so willingly giving up their time and sharing their experiences with me.

I would like to thank the team leaders, coaches, and colleagues, especially at the South East network, at Wellington City Libraries for the support they have given me as I worked on and completed this project.

I would like to thank my library manager, Laurinda Thomas for allowing me permission to conduct this research at Wellington City Libraries and for ongoing support and advice.

I would like to thank my friends and acquaintances at Never Stop Dancing, Swing Central and Kapiti Hutt Ceroc for ongoing support, patience, laughing, dancing and providing me with a much-needed break from study when needed.

Special thanks to Louise Dowdell and Clare Lundon for much invaluable advice and guidance.

Finally, I would like to thank my family and friends, especially my mother, Cheryl for her ongoing support and patience throughout duration of the research project and study towards the Master's degree in Information Studies.

This report is dedicated in memory of Ruth Gotlieb, a well renowned Wellington local government veteran, and who will always be remembered her long-standing dedication to public service and libraries.

"Librarians are the salt of the earth and libraries are the cornerstone of civilization" –

Ruth Gotlieb – 16th May 1923 – 23rd July 2019.

Table of Contents:

1. Introduction **7**
1.1. Topic Statement 7
1.2 Rationale for study 7
1.3. Research Question 9
1.4. Operational Defintions 10
2. Literature Review **12**
2.1. An Informal Learning Phenomenon 12
2.2. Use of STEAM in Public Libraries 14
2.3. STEAM tools and resources 17
2.4. Success in Collaboration and Partnerships 18
2.5. Issues and Challenges 19
3. Methodology **21**
3.1. Sample Size 22
3.2. Data Collection 24
3.3. Data Analysis 24
3.4. Ethical Considerations 26
3.5. Conflict of Interest 26
3.6. Limitations 27
3.7. Delimitations 28
4. Results **29**
4.1. STEAM CYA programmes and services at WCL 29
4.2. Goals and Objectives 31
4.3. Education vs Recreation 34
4.4. Measurement of Success 36
4.5. Issues and Challenges 39
4.6. Central Library Closure 44
4.7. Waitohi Library and future Makerspace 45
4.8. Does STEAM have a place in libraries? 45
4.9. Librarians' role in delivering STEAM 47
5. Discussion **49**

5.1. How STEAM is incorporated at WCL 50
5.2 An informal and inclusive learning environment 50
5.3. Libraries as a third cornerstone to STEAM Education 51
5.4. Libraries and the library profession is continually evolving and changing 53

6. Conclusion 55
6.1. Implications 56
6.2. Further research 57

7. References 58

8. Bibliography. 71

9. Appendices 75
9.1 Appendix A: Participant Information Sheet 75
9.2 Appendix B: Participant Consent Form… 78
9.3 Appendix C: Partipant Interview Questions 80
9.4 Appendix D: List of robotics and electronic eqiupment in each makercart housed at various WCL networks 81
9.5 Appendix E: Cost of robotics housed in the makercarts…… ……82

1. Introduction:

1.1. Topic Statement:

The aim of this project is to investigate and research what New Zealand public libraries are offering in terms of STEAM (Science, Technology, Engineering, Arts and Mathematics) based services and programmes for children. I used my workplace, Wellington City Libraries (WCL), as a case study, by interviewing seven staff members working in Children and Youth (CYA) services, who also run STEAM based services and programmes. The research aims to gain perspective on their experiences, thoughts and opinions of the incorporation of STEAM learning within CYA services and programmes. The outcome of this research will hopefully provide more knowledge and a better understanding of how New Zealand public library STEAM services and programmes can be improved. The knowledge could provide a framework to develop STEAM and library policies, practice and services that meet the needs of library users (children and their parents).

1.2. Rationale for study:

STEAM or STEM is an educational approach that focuses on science, technology, engineering, arts and mathematics to encourage children to learn (Yakman, 2008) and develop important skills that will serve them well when they pursue academic study and the job market if they choose STEAM related career paths (Commonwealth of Australia, 2016; Engler, 2012; Jolley, 2014; Li and Todd, 2019; Ministry of Education, 2019).

The Ministry of Education in New Zealand (2019) reported:

“Global skill shortages in STEAM-related fields are redefining educational priorities. Schools are starting STEAM-based learning programmes to equip students with the skills and knowledge needed to thrive in the 21st century. STEAM learning will not only produce tomorrow's designers and engineers; it

will develop innovative mind-sets and the ability to problem-solve, ensuring that our students become creators of technology, not just passive consumers" (Ministry of Education, 2019).

Public libraries, both within New Zealand and overseas are working towards adopting the STEAM educational approach as a framework for their services and programmes for children and youth (Bartlett and Bos, 2018).
The rationale is to encourage children to develop STEAM based skills from an early age (Beauchamp, 2019; Bradshaw, 2019; Freeman, 2019), to further them towards STEAM related career paths to and help address the global skill shortage (Taylor-Jorgensen, 2019). More libraries are incorporating STEAM programmes, such as "makerspaces for their students, clients and consumers in the creation of information and knowledge" (Moorefield-Lang, 2015, p.358). Bayek, (2013), reported:

*"Libraries are an important institution that serves the learning needs of its community. STEM is an important lifelong endeavor and libraries are uniquely positioned to support lifelong learning of STEM for members of their community. Thinking of libraries as a third place for learning STEM is one approach to resolving librarians' perceptions of STEM learning at both an individual and community level" (*Pp.13-14).

Public libraries are breaking away from just providing traditional lending service and moving towards serving as community hubs, where people can connect and learn technological and problem solving skills (Bayek, 2013; Koester, 2013). In this way, public libraries are embracing the opportunity to be informal learning spaces to support and adopt STEAM programmes and services to provide an inclusive environment where all members of the community can take part and learn, as well as sparking natural curiosity and engagement (Bayek, 2013; Cun, Abramovich and Smith, 2019; Li and Todd, 2019; Tait, et al, 2016).

There is some published research and media coverage of what public libraries are offering in STEAM based services and programmes for children, especially with the use of makerspaces (Cun, Abramovich and Smith, 2019; Dugmore, Johnston, 2018; Li and Todd, 2019; Lindop and Baruk, 2014; Moorefield-Lang, 2015). However, STEAM in New Zealand Public libraries are still new and the research topic presents an opportunity to further research and disseminate what public libraries in New Zealand are offering in STEAM based services and programmes for children. The intended focus is on improving the quality of the STEAM based services/programmes presented and delivered to the intended audience (Bayek, 2013; Troxel, 2016).

1.3. **Research Question:**

The main question this research will investigate is:

- How are New Zealand public libraries incorporating STEAM Education into their services and programmes for children?

This is expanded through the following sub-questions:

What STEAM programmes and services are currently being offered at New Zealand public libraries?

What is the desired goal and outcome (from the perspective of New Zealand public librarians) of the delivery of STEAM based programmes and services?

Do the STEAM based programmes and services have an education or recreation based focus?

How is the delivery of STEAM programmes and services measured and evaluated, especially in terms of success?

Are the STEAM services and programmes successful? Is the desired goal and outcome achieved?

What are the issues, challenges and obstacles that New Zealand public libraries face when delivering STEAM programmes and services?

1.4. Operational Definitions:

- **Code Club:** "A Code Club is a voluntary initiative, founded in 2012, which aims to provide opportunities for children aged 9 to 13 to developing coding skills through free after-school clubs" (Wikipedia, 2019).

- **Children and Young Adult (CYA) and Children and Youth Services, (CYS):** A set of keywords used to identify core team members/librarians that work in services and programmes targeted at Children and Youth at Wellington City Libraries.

- **Makerkit: "**A maker cart is a set of maker resources that can be transported from library to library to enable pop-up maker spaces. In the context of this paper, the resources discussed are technology-based rather than tactile or craft based" (Piggot, 2018).

- **Makerspace: "**A makerspace is a place where students can gather to create, invent, tinker, explore and discover using a variety of tools and materials" (Rendina, 2015).

- **Robotics:** "The branch of technology that deals with the design, construction, operation and application of robots" (Oxford Dictionary, 2019).

- **STEAM: “**STEAM is an educational approach to learning that uses Science, Technology, Engineering, the Arts and Mathematics as access points for guiding student inquiry, dialogue, and critical thinking” (Education Closet, 2018; Ministry of Education, 2019; Yakman, 2008).

- **STEM: “**STEM is a curriculum based on the idea of educating students in four specific disciplines — science, technology, engineering and mathematics — in an interdisciplinary and applied approach. Rather than teach the four disciplines as separate and discrete subjects, STEM integrates them into a cohesive learning paradigm based on real-world applications” (Horne, 2014; Yakman, 2008).

2. **Literature review:**

The literature review starts by summarizing the definition, phenomenon and experience of STEAM or STEM being used in schools and public libraries and outlining the advantages and disadvantages (2.1 and 2.2). There is discussion of how STEAM is used in public libraries (2.2) followed by a description of tools and resources used in STEAM related programmes and services (2.2 and 2.3). There is then a discussion of collaboration and forming partnerships with other organizations that play a role in successful STEAM programmes and services in public libraries (2.4). The literature review concludes by examining issues and challenges that libraries face when delivering STEAM programmes and services (2.5).

2.1. **An informal learning phenomenon:**

STEAM, also known as STEM, is an educational approach that focuses on science, technology, engineering, arts and mathematics to encourage children to learn and engage in critical thinking (Yakman, 2008). Proponents claim STEAM will bridge the digital and technological divide to ensure children learn the skills needed to ensure long term employment in the global workforce (Australian Industry Group, 2015, Core Education, 2019; Eger, 2015; Lepla, 2016; Liao, 2016; Yakman, 2012). Boyes, (2017); Laurenson, (2018) and Lepla, (2016), claim that STEAM skills and capabilities will play an important and vital role for learner's academic success, future job prospects, and chosen careers that underpin many of New Zealand's growth enterprises (Boyes, 2017; Laurenson, 2018; Lepla, 2016).

Core Education (2019), examined the driving force behind STEAM, which is:

"to ensure young people are given the opportunity to experience and develop an interest in the key areas of science, maths, and technology so that they emerge from school ready to take up roles in these sorts of industries."

Existing research indicates that STEAM is a multifaceted education system where the learner will learn a variety of skills and help their natural curiosity

transform into keen interest and lifelong learning (Education Closet, 2018; Eger, 2015; Horne, 2014; Liao, 2016; Ministry of Education, 2019). The research further examines the phenomenon and experience of STEAM being used to teach children in schools both New Zealand (Dougan, 2016; Ministry of Education, 2019; Westlake Girls High School, 2019), overseas (Armknecht, 2015; Chastain, 2014; Copley, 2018; Jho, Hong and Song, 2016; Roberson, 2015; Yakman and Lee, 2012) and discusses the type of STEAM based services and programmes offered to children.

There has been some criticism of STEAM being another *fad* (Wujick, 2013), *elitist* (Runge, 2013) and students not receiving enough instruction and development in mathematics, science and technology literacy (Wujick, 2013). Runge (2013) discussed there are no set guidelines or programmes in STEAM learning, for example what children should be learning, and the possibility that some STEAM programs may not be adequately preparing children for adult life and the job sector. Runge (2013) examined other disadvantages of STEAM, where it is not introduced and applied until children are already in middle school, “which many professionals believe is too late to make a real impact” (Runge, 2013). Runge (2013) also discusses the need for STEM to be emphasized at an early age, for example during primary school, or children could lack the basic skills necessary to learn more complex ideas and problem solving in other STEAM programs. This is where other experts (Beauchamp, 2019; Bradshaw, 2019; Freeman, 2019) would agree that infancy to age six are the stages where children should be introduced to behavior, concepts, language and having a “hands-on” learning experience which is related to the STEAM learning style of being a “hands on experience” that could further encourage problem solving and STEAM related skills (Beauchamp, 2019; Bradshaw, 2019; Freeman, 2019).

Hacker (2016) discusses in his book, *The Math Myth: And Other STEM Delusions,* concerns that STEM is over-emphasized in education, which could prove as a disadvantage to students’ academic success. Murawki (2016) critiqued Hacker’s book and believed Hacker (2016) felt that STEM could be

fueled by a “manufactured crisis and is having destructive consequences for our society” (Murawki, 2016).

Hacker (2016) examines and describes STEAM as “a major mythology of our time; an ideology, an industry, even a secular religion” (Murawki, 2016). Hacker (2016) also believes that STEAM provides a narrow range of skills and talents to the detriment of learners who do not naturally possess STEAM skills.

The literature highlights STEAM as an informal learning phenomenon that schools and libraries both in New Zealand and overseas, use to teach students as an alternative way of developing science, technology, engineering, arts and mathematics. There are experts who claim STEAM is beneficial to academic and career success while other experts are skeptical of STEAM education and believe it is a trend that has no impact on students excelling in academic or career performance. The literature also highlights the advantages and disadvantages of STEAM education. Some findings could potentially parallel with this research.

2.2. **Use of STEAM in Public Libraries:**

There is research on public libraries adopting STEAM education and STEAM related themes and ideas as part of their services and programmes for children and youth (Australian Industry Group, 2015, Boyes, 2017; Civica, 2018; Hamilton City Libraries, 2019; Ministry of Education, 2019) both in New Zealand, (Australian Public Library Association, 2017, Hamilton City Libraries, 2019; Khoo and Cowie, 2018; University of Waikato, 2019), and overseas (Australian Public Library Association, 2017; Barlett and Bos, 2018; Koester, 2015; Slatter and Howard; 2013). There have also been published accounts of successful STEAM services and programmes in public libraries (Australian Public Library Association, 2017, Bartlett and Bos, 2018; Hamilton City Libraries, 2019; Khoo and Cowie, 2018; Koester, 2013).

Published literature reports that public libraries are starting to serve as informal learning spaces to support and adopt STEAM programmes and services to

ensure an inclusive environment, ensuring all members of the community can take part and learn, as well as sparking natural curiosity and engagement (Bayek, 2013; Cun, Abramovich and Smith, 2019; Li and Todd, 2019; Tait, et al, 2016). Cun, Abramovich and Smith, (2019), Dusenbury, (2014) and Koester (2013) discuss how incorporating STEAM into public library programmes and services for children presents opportunities for children to learn about STEAM in an informal learning environment; facilitate programmes and services that focuses more on children's natural interests and giving them a chance to explore and experiment (Cun, Abramovich and Smith, 2019; Dusenbury, 2014; Koester, 2013) and allows patrons of all ages and various learning levels to learn and create (Bayek, 2013; Cun, Abramovich and Smith, 2019). Public libraries provide opportunities for low-income families, who may not have access to up-to-date resources and technology outside school to be provided with those resources in a public library setting (Roberson, 2015; Slatter and Howard 2013; Li and Todd, 2019; Noh 2017).

Bayek (2013) discusses the importance of Public Libraries "as a venue for learning science, technology, engineering, and mathematics (STEM)" (p.3). Bayek (2013) illustrates how STEM encompasses the public library's mission of supporting lifelong learning for members of the community. Bayek further discusses how public libraries can serve as a third place (the home and school being the first and second place) for children to learn STEAM related skills. While Bayek discusses the importance of STEAM or STEM in libraries, there is no discussion of any examples of potential STEAM based programmes and services that public libraries could offer as a way of engaging with communities.

Barlett and Bos's (2018) paper examines the planning, organising and implementation of their STEAM programmes, at Mount Prospect public library. They used STEAM as a framework or guide for creating STEAM based services and programmes for children, such as The Dia programme, with the objective of having "a hands on" (Bartlett and Bos, 2016) learning approach, as well as catering to a diverse group of children. This resulted in strengthened community

relationships and attracted first time library users. Information about Bartlett and Bos's STEAM programmes and services are also listed on their blog, "STEAM Around the World." The blog provided insight into the programmes they developed, budget, planning, appendices

and other STEAM related information that could serve as a framework and guide for other libraries and implementing future STEAM programmes and services.

Amy Koester, a children's librarian at Skokie Public Library published a toolkit based on her experience as a STEAM/CYA librarian. Koester's (2015) toolkit provided information on previous STEAM programmes she implemented at Skokie Public Library. The toolkit provided information about STEAM on how to implement STEAM in Public Libraries and the important role it plays in society. Koester (2015) discusses the importance of having diverse STEAM programmes to ensure ongoing participation and inclusion with further suggestions on the use of resources and forming partnerships. The document concluded with a list of sample science-based STEAM programmes and further references to consult. An outline of STEAM programmes, ideas, resources and what other public libraries in the USA are doing with STEAM is also listed on Koester's library blog, *"The Show Me Librarian",* under the section, *"All things STEAM."* These resources provide information of vital importance that could parallel, effect and improve current policy, practice and delivery of library CYA STEAM programmes and services to develop children's STEAM skills.

Richards (2017) presented a paper at a conference in Sydney 2017 called "How Public Libraries Contribute to the STEM Agenda", reporting on successful STEAM Programmes and libraries which were:

- A Code Club at Leichardt Library, Australia, which enabled children to learn technology skills that meet the STEAM goals, as well build connections with each other.

- A media lab and Fab lab in Quebec, Canada, at Brossard Public Library and Repentigny Public Libraries, which contained STEAM tools such as 3D printers, laser cutter, digital sewing machine, vinyl and paper cutter, hot press, electronic and computer components.

- Hutt City Libraries ran Clubhouse13 after-school program for 10-18 year olds in two of its highly-deprived communities that could learn STEAM skills such as “completed basic electronics projects with makey-makey kits, mashed up circuitry with fashion design, recorded tracks, and created start-up businesses” (Australian Public Library Association, 2017).

There is research that reports not all libraries or librarians are welcoming of STEAM in libraries (Curiosity Commons, 2017; Mahar, 2018; Slatter and Howard, 2013). Slatter and Howard (2013) discussed how library staff can be reluctant to embrace change in their libraries and patrons were hesitant to embrace advanced technologies and new directions in library programming (p. 277). Slatter and Howard (2013) further discussed how the librarians in their study found it a challenge to “translate the value and relevance of new and different programs and technologies to those who are used to a more traditional library model. Indeed, there was a steep learning curve for all” (p. 277). Maher (2018) discusses how some librarians felt there were issues with the Makerspaces being messy, noisy and disrupting the quiet reading spaces of a library (p.25).

The literature presents an account of public libraries, both within New Zealand and overseas who are starting to adopt STEAM education and STEAM related themes/ideas as part of their services and programmes for children and youth. Overall, the findings from the literature provide valuable insights into the wider context of the importance and use of STEAM in public libraries. There is a description of the STEAM programmes and services that have been delivered where it has been widely welcomed by librarians and the community, while at the same time noting some resistance from staff and communities.

2.3. **STEAM tools and resources:**

STEM or STEAM, as well as the innovations encompassed within the learning platform, such as makerspaces (Gahagan, 2016; Moorefield-Lang, 2015), are a new, growing innovation for libraries. Existing programmes and services, both in schools and public libraries, consist of some, if not all, of the following:

- Makerspaces and/or makercarts (Gahagan, 2016; Piggot, 2018).
- Code clubs.
- Lego clubs.
- Robotics.
- 3D Printing (Cun, Abramovich and Smith, 2019).
- Minecraft. (Cun, Abramovich and Smith, 2019).
- Virtual reality (Cun, Abramovich and Smith, 2019).
- Learning Labs (Hamilton City Libraries, 2019).

The research on STEAM provides interesting insight into what public libraries in New Zealand and overseas offer in STEAM resources. The extent to which WCL's programming and activities are similar or differ are explored in this study to analyse whether the service could be extended and improved.

2.4. **Success in collaboration and partnerships:**

Hopwood (2012), Overbey, Dotson and LaBadie (2018) and Roberson (2015) all discuss how public libraries have successfully delivered STEAM programmes in partnerships with schools, business sectors, academic institutions and research labs. There has been further suggestion that public libraries could work together with business sectors, research labs and academic institutions to create and deliver STEAM programmes and services to children. This could increase knowledge and exposure to STEAM topics and tools to

encourage academic success and future job prospects (Overbey, Dotson and LaBadie, 2018).

Bartlett and Bos (2018) discussed how forming partnerships with other organizations, for example Language Stars and the Turkish Cultural Center, served as a method of delivering STEAM related programmes. Bartlett and Bos (2018) justified forming the partnerships as way of providing space in the community for programs therefore making them accessible to the wider community.

There has been published research by Dr Elaine Khoo & Professor Bronwen Cowie, on a successful collaboration between educational researchers at the WIlf Malcolm Institute of Educational Research (WMIER) and Hamilton City Libraries. One of the objectives of the research was to “investigate the impact of introducing and implementing mobile makerspaces and digital-based learning resources to foster community awareness and engagement with STEAM (science, technology, engineering, arts and mathematics) activities” (Khoo and Cowie, 2018; University of Waikato, 2019). Another objective identified was “to inform future public and community educational initiatives to foster informal and non-formal learning of STEAM understanding and skills through establishing mobile makerspaces” (Khoo and Cowie, 2018; University of Waikato, 2019). The findings indicated that the parents of children participating were happy with the level, delivery and resources used in the LAB programmes, and the informal learning their children gained from participating in the programme. There was some negative feedback about children not having enough time to use the resources and concerns about venue space being small. The report concluded with recommendations on improvements on programme visibility; scheduling and venues; quality of facilitation in the programme; nature of activities; facilitating children’s coding skills; Internet safety awareness; and, ongoing community feedback (Khoo and Cowie, 2018; University of Waikato, 2019).

Khoo and Cowie’s (2018) research highlights a successful partnership and collaboration between libraries and industries. It demonstrates how libraries with

limited space and resources can work with community organizations to provide space in the community for programs, therefore making STEAM services accessible. This project explores how WCL collaborates and partners with other community organizations.

2.5. **Issues and Challenges:**

Published literature discusses the issues and challenges when delivering STEAM services in libraries.

Issues and challenges include STEAM resources being expensive and libraries having a limited budget or funding to sustain their cost (Curiosity Commons, 2017; Greene and Groenendyk, 2018; Li and Todd; 2019; Moorefield-Lang, 2015; Slatter and Howard; 2013). Further issues and challenges range from shortage of staff; training and confidence in using equipment (Curiosity Commons, 2017; Li and Todd, 2019; Moorefield-Lang, 2015; Pope, 2018), concerns over liability and copyright associated with materials, (Slatter and Howard, 2013, p.278); maintenance of technology equipment, high noise levels and resistance to change (Curiosity Commons, 2017; Greene and Groenendyk, 2018; Moorefield-Lang, 2015; Slatter and Howard; 2013).

Greene and Groenendyk (2018) reported problems with facilitating an augmented and virtual reality, (AR and VR), programme at McGill University Library, ranging from shortage of staff, the purchase of the AR and VR being expensive, especially when the library had a limited budget; the programme being a time-consuming process to facilitate to the students; making sure the AR and VR headset were charged and were of low risk of being stolen or damaged.

Pope (2018) discussed technology issues which included equipment not working; limited resources, equipment maintenance and technology updates.

Lankes' (2014) paper reported there was pressure put on librarians to be a teacher, Information and Communication Technologies (ICT), specialist or an

expert in the field of STEAM equipment, mainly technology, robotics, and so on. Lankes (2014) felt the positon of librarians was not to be a teacher or a STEAM expert, but rather continue their job as librarian as a facilitator and provider of STEAM based equipment, that the public could access and have free use of.

This project explores if WCL experiences similar issues and challenges as presented in the literature, as well as new findings that is not reported in other literature.

3. Methodology:

A qualitative approach was used for this research project. Qualitative research studies are defined as investigating a phenomenon in their natural setting to make sense of the meaning that is brought forward by the people (Denzin & Lincoln, 1998; Small, 2018). This was considered appropriate because it presented the opportunity to explore the phenomenon of what New Zealand Public Libraries are offering in terms on STEAM based services and programmes for children. Qualitative research uses methods of collecting data which range from observation, interviews, or focus groups and may also include written documents and case studies (Small, 2018). Qualitative research methods enabled me to explore the perceptions of the CYA staff at Wellington City Libraries, and how they view STEAM learning within CYA services and programmes, by gathering data on their thoughts, opinions and experiences (Morrison, Haley, Sheehan, and Taylor, 2002). The research fits within a phenomenological study and attempts to understand people's perceptions and perspectives relative to a situation, and tries to answer the question: What is it like to experience such-and-such? (Leedy and Ormerod, 2015, p.273)
Using qualitative research methods also enables me to find out what STEAM programmes and services are offered, by asking librarians, during an interview, who work and are specialized in CYA and STEAM services, to seek evidence of categorical responses of individual themes and subjects (Zaidah, 2007, p.4). The detailed qualitative accounts from the librarians not only helped to explore or describe the data of STEAM in real-life public library environment, but also helped to explain the complexities of the real-life situations in STEAM education programmes and services, which may not be captured through other qualitative and quantitative research methods (Zaidah, 2007, p.4).

I used my workplace, Wellington City Libraries, as a case study. A case study is:

"An empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 1994).

Alpi and Evans (2019) and Yin (1994) further describes a case study as a method of empirical inquiry exploring the "how and why" of a phenomenon and contributes to understanding the phenomenon in a holistic and real-life context. The interaction between a phenomenon (STEAM), and its context (WCL), is best understood through in-depth case studies (Dubois and Gadde, 2002). A case study approach presented the opportunity to learn more about STEAM in CYA services and programmes within a public library as, due to STEAM being new, not much previous research has been undertaken in the field. Leedy and Ormrod, (2015) report that case studies are a suitable approach for learning more about a situation that is not well known or understood (p.141). The advantages of investigating this topic, as a case study, was the examination of what STEAM programmes and services for children are used, and is conducted within the context of a public library environment (Zaidah, 2007). Common research instruments used in case studies include surveys; interviews; observations and artifacts (Alpi and Evans, 2019; Iowa State University, 2019). For my research, I explored the phenomenon of STEAM in public libraries by interviewing librarians and asking questions, such as *"How are New Zealand public libraries incorporating STEAM Education into their services and programmes for children?"; "What STEAM programmes and services are currently being offered at New Zealand public libraries?"; "What is the desired goal and outcome (from the perspective of New Zealand public librarians) of the delivery of STEAM based programmes and services?",* and so on (Appendix C). These general questions are meant to serve as a method of collecting data as evidence to understand and further examine the phenomenon (STEAM children's services in public libraries) (Alpi and Evans 2019; Zaidah, 2007).

3.1. Sample Size:

I conducted interviews with a purposive sample of seven participants. The participants ranged from one makerspace specialist, two Children and Youth (CYA), specialists and four CYA Librarians (Team Members), employed at Wellington City Libraries, (WCL), working at four different WCL networks. The size of the sample and the participants were chosen for the following reasons:

- The time and effort to organise, schedule and conduct interviews was manageable because I knew and had worked with the librarians in a professional capacity in CYA and STEAM related projects, programmes and services.

- The participants in question had in depth knowledge of CYA and STEAM services from a strategic (Makerspace and CYA Specialists), and operational view point, (Team Members). Interviewing these participants enabled me to gather their perceptions, experiences, and expectations of STEAM programming and services for children at Wellington City Libraries, as well as thoughts and concerns that they may have about programme, operation, processes, outcomes, and any changes they perceive, (in themselves and Wellington City Libraries), because of their involvement in the STEAM programmes and services. The Makerspace specialist designs makerspace and STEAM programming in an informal learning space for the local community. The CYA specialists' designs and co-ordinates CYA programmes and services for children. Some of the programmes and services in the CYA services encompass elements of STEAM education. The librarians/Team Members who work as CYA librarians and in the STEAMED team implement and deliver these services.

- The librarians in the sample also represented individual library branches, or network systems that serve various geographical areas in Wellington. Johnsonville and Tawa branches represent the North network or cluster;

Kilbirnie, Miramar, Island Bay and Newtown branch libraries are classed as the South-East cluster; Karori, Khandallah and Cummings Park represent the West cluster and the Central Library (which closed in March 2019 due to earthquake issues), Arapaki Manners Street, Brooklyn and Wadestown represent the Central part of the Wellington Public library network.

3.2. Data Collection:

Interviews are a systematic way of talking and listening to people about their experiences and are another way to collect data from individuals through conversations and asking questions (Kajornboon, 2005). In the case of this research, the interviewees (librarians) discussed their perception and experiences in incorporating STEAM into CYA programmes and services at WCL. Cohen, Manion and Morrison (2000, p. 267) explain the interview is not simply concerned with collecting data about life: it is part of life itself, its human embeddedness is inescapable.

Interviewing librarians allows the opportunity to probe deeper into this research (Kajornboon, 2005). For example, throughout the interview, when they answered the question, *"What STEAM programmes and services are currently being offered at WCL?",* this invited the opportunity for me to probe deeper by asking *"Can you please tell me more"* or *"Can you describe the programme further"*, and so on. Therefore, with this type of interview I could ask more open-ended questions and gain further insight into the librarians' situations (Kajornboon, 2005).

The interview questions (Appendix C) are relevant to the topic I researched and research question(s) I wanted to answer (Lumen Learning, 2017). Each question contributed to answering the research question(s) and understanding the topic (Lumen Learning, 2017).

The interviews were conducted in person. Participants were given an information sheet, and consent form to sign and return before interviews commenced. Data was collected and documented using a recording app on my smart phone and transcribed into written notes, using word processing software. I also invited the participants to review written copies of the transcripts from interviews to confirm the information had been transcribed accurately.

3.3. Data Analysis:

When the participants were satisfied with the written transcript, I used a mixture of deductive coding, (exploring the phenomenon of STEAM and finding evidence to answer the research questions) and inductive coding, (additional themes and generating meanings from the data collected to identify patterns and relationships) (Dudovskiy, 2019; Saunders, Lewis, and Thornhill, 2012). These methods of coding are suitable analytical methods because it involves in-depth reading and analysis of the written transcripts to identify useful data that are of relevance to the research questions (Hiest, 2012; Leedy and Ormrod, 2012; Miller, 2013; Thomas, 2006).

I worked through hardcopies of the transcripts and assigned different colors, with highlighters, to different themes, (Braun & Clarke, 2006; Maguire and Delahunt, 2017). The use of color coding makes it simple to see which parts of the text belong to which category of the research questions (Maguire and Delahunt, 2017). For example, green was used to code themes relevant to education and recreation and orange coded theme relevant to issues and challenges.

Further analysis was conducted to condense the data from the interview transcripts into a summary of results from the participants' answers to establish clear links between my research questions and results, and allow the findings to emerge into themes inherent in the raw data (Thomas, 2006). The process involved reading and re-reading the transcripts to identify themes and categories (Jain & Ogden, 1999, p. 1597); in addition, emerging themes (or categories) were developed by studying the transcripts repeatedly and

considering possible meanings and how these fitted with developing themes (Marshall, 1999; Thomas, 2006).

I also analyzed the documentation of relationships between themes and the identification of themes important to participants, for example in one transcript, there was an overlap of issues and challenges concerning measuring success of CYA STEAM programmes at WCL (Elliott and Gillie, 1998; Thomas, 1996). Similarities and differences across sub-groups were also explored (Elliott and Gillie, 1998, Thomas, 1996).

Any quotes or findings supplied by librarians in the transcripts are made confidential in the report and are given the identifiers ranging from Librarian A to G to protect anonymity.

3.4. Ethical Considerations:

Before the project commenced, I obtained permission from the Library Manager at Wellington City Libraries to use the organization as a case study, to interview participants and, if needed have access to data, for example documents and reports in relation to STEAM and CYA programmes and services. The library manager gave approval for Wellington City Library to be named as the case study in the report. We also discussed maintaining confidentiality of the participants' involvement and ethical considerations. Before interviews and data collection commenced, I received approval from the School of Information Management Human Ethics committee, (HEC). I explained the purpose of the interviews, why the participants have been chosen, the expected duration of each interview and other relevant information using the information sheet supplied by Victoria University Wellington School of Information human ethics committee (Appendix A). Each participant signed an informed consent form, using the written "informed consent template" supplied by Victoria University Wellington School of Information human ethics committee, (Appendix B), and were supplied with a list of questions, (Appendix C), that I would be asking throughout the interview.

3.5. Conflict of Interest:

As I was undertaking research within my workplace, interviewing my professional work colleagues with whom I work with, there was the risk of a conflict of interest, (COI), which is defined as:

"A set of circumstances that creates a risk that professional judgement or actions regarding a primary interest will be unduly influenced by a secondary interest" (Ghooi, 2015; Central Drug Standards and Control Organization, n/d).

I reported any COI's, both orally and in writing, both to my supervisor, library manager and HEC. I fully disclosed work place relationships that could constitute a conflict (Elsevier, 2015), in my HEC application and a "conflict of interest" form supplied Wellington City Council (WCC).
I had regular contact with my supervisor and library manager both face to face and by email, always updating them on news and progress throughout my research. I submitted copies of my interview transcripts and any relevant information to my supervisor to verify its integrity.

I abided by the guidelines and policies of HEC and WCC during the research project. For example,

"The research will be conducted in a fair, honest, impartial and transparent manner, after full disclosure is made by those associated with the Study of each aspect of their interest in the Study, and any conflict of interest that may exist" (Ghooi, 2015; Central Drug Standards and Control Organization, n/d).

While conducting interviews and my research, I believe, to the best of my ability, I acted accordingly and abided by the policies outlined by HEC, concerning interviewing human subjects and abiding by the chain of ethics. Throughout the research, and interviews, I acted in an unbiased and unprejudiced manner. I maintained professional integrity, honesty, transparency, openness, independence and good faith that served in the interests in conducting and

completing my research (Brady, 2007; New Zealand Government Procurement, 2019).

I was open to participants providing feedback on how I behaved during the interviews. All participants appeared comfortable throughout interviews and signed off that they were happy with the information documented which resulted with positive feedback. There was some feedback due to typo errors. One participant provided feedback via email that they were pleased with the presentation of the information provided in the transcript and that it added credence to their professional role and expertise.

3.6. Limitations:

- The study is confined to research current CYA STEAM programmes and services at Wellington City Libraries.

- Participation in the research was restricted to seven librarians due to their area of expertise in CYA and who are active members of the STEAMED working group at WCL.

- Research was conducted between March and July 2019 during the Central Library closure.

3.7. Delimitations:

- The study employs a sample technique that excludes other New Zealand libraries and overseas libraries, staff, CYA and STEAM services and programmes, and other fields related to the research.

300061394

4. **Results:**

In exploring the research objectives and questions, the following findings and themes from the interviews were identified.

4.1. **STEAM CYA services and programmes at WCL:**

The participants' responses confirmed that STEAM themes and elements were incorporated into school visits, holiday programmes and existing CYA services. The use of technology was a common theme within the results. Common uses of technology ranged from the use of the virtual reality headsets, (VR), and robotics used when schools vising the libraries and in holiday programmes. The STEAMED librarians have been doing a lot of outreach visits to schools, where librarians take a makerkit, which holds a variety of mainly robotics and electronics (Appendix D).

Some of the programmes led by librarians who were part of the STEAM Education group (STEAMED), were regular and formalised, for example, Code Club, (run in partnership with Code Club Aotearoa), Tech Time, (which was an after school programme where children could have a play with various technology in the makerkit), Crafterschool, which covers the artistic side of STEAM, and Let's go Lego, which involves engineering and design. One participant explained:

"On one level, we have the programmes that are specifically designed as STEAM programmes or events… that take at their core the kind of holistic approach that STEAM entails, where we're trying to combine multiple learning strands in the fields of science, technology, engineering, arts and mathematics... The second approach we take into incorporating STEAM into our suite of programmes and services is by taking traditional programmes and where appropriate try to incorporate STEAM elements into them… an example

is the class visits programmes, preschool storytime, Baby Rock and Rhyme, STEAM workshops, crafterschool, craft groups, and so on." (Librarian F).

Other STEAM services and programmes were *"experimental",* (Librarian G), and *"one off events"* (Librarian F), as a way, according to Librarians F and G, of overcoming challenges related to shortage of staff, limited funding and limited resources. Librarian F went further to report that a lot of the STEAM based programmes were *"currently under development".*

"With one off programmes, we don't have to make the continued commitment of staff and resources to give that programme or event longevity…with the holiday programmes, it is less on an issue, because we don't have to think about the long-term impact. We only should worry about staff and resourcing for a limited amount of time" (Librarian F).

Librarian F provided a couple of interesting examples of how STEAM elements could be incorporated into existing CYA services, using one example of incorporating Ozobots, (robotics and technology) and the fairy tale, Hansel and Gretel, (storytelling and learning about characters), where the children can draw the trail that Hansel and Gretel follow in the story and get the Ozobots to act out that part of the characters in those books. Librarian F further reported a second example where staff at one of the North Cluster Libraries managed to incorporate a CUE robot (technology) and the use of Lego (Engineering), where the children had built a Lego attachment for the robot, so the robot could hold colored pens and pencils. They then programmed the robot to draw a design on the craft piece they were making rather than drawing it themselves, (Art). Two participants (Librarian A and F), also talked about examples of how various library networks were trying to augment Code Club with the robots, as a way of giving children a way to progress and graduate from Code Club.

"…that's an example of an approach that staff have been taking where they take a programme, which on the surface doesn't involve STEAM at all and adding an extra STEAM layer to it (Librarian F).

Librarian B commented how Baby Rock and Rhyme has elements of the Mathematics side of STEAM, because of the incorporation of numeracy in songs and stories to help children learn basic maths. Librarian B also remarked on how the arts strand was also incorporated in Baby Rock and Rhyme, where librarians act out the movements, linking to the arts of performance and theatre.

"That is part of the STEAM programme, because you're showing them body positions, turning around and movement, and serves as an early introduction to the arts. Then you progress from the Baby Rock and Rhyme to the preschool storytime, where they are learning comprehension and numeracy skills" (Librarian B).

Other than Baby Rock and Rhyme, at least three participants observed that not a lot of mathematics has been incorporated into the CYA STEAM services at this stage; however, this is an area that the STEAMED group hope to explore once the new Johnsonville Library (Waitohi) is up and running.

"We haven't been doing a huge amount in the music and maths sides, yet. That will kick off once Waitohi Library is open and we have access to the studio, 3D printers, and all the electronics kits are up and running" (Librarian A).

There was feedback from two participants on how there is, currently no formal or written STEAM based lesson plan or programmes that has been written up and been documented as official and ongoing programmes offered to children. There is also no makerspace or learning lab in any branch libraries where children can go and enrich their creativity and innovation skills.

"We don't have official STEAM related programmes and services as such, but we do a lot of STEAM themed topics throughout class visits" (Librarian D).

4.2. **Goals and objectives:**

When asked "*What is WCL trying to achieve with STEAM programmes and services?"* responses from the participants linked to the existing research (Bayek, 2013; Slatter and Howard; 2013) focusing on how libraries are now breaking away from the traditional service of being a book repository and are leaning towards being a community hub for social interaction, activities, a recreational space and *"as a touchpoint" (Librarian A).*

"The idea that libraries are a hub for social interaction, activities and a recreational space rather than a book repository, can attract and serve a diverse range of users" (Librarian E).

Access and inclusiveness:

The responses to this question indicate that a key goal of STEAM programming is to attract and serve a diverse range of existing and new users and create an open community public space where users can have access to STEAM related technology that they wouldn't otherwise have access to, for example, robotics, technology equipment, iPads and so on (Li and Todd, 2019).

"… libraries are striving to strengthen communities; to increase understanding and appreciation of different literacies; and, one of our goals is to create opportunities, focusing on equity and equality, for access to information and the things that they need to participate in a modern society in a democratic way" (Librarian G).

Other responses from the participants about the aims of STEAM initiatives included:

Connection:

Librarian C believed the goal of STEAM was connecting communities to information, which is also encompassed with WCL's customer charter which is *"to connect our communities to knowledge, wonder and possibilities"* (Wellington City Library, 2017, p.1)

"I feel it connects very well with what libraries do and connecting people with information. I feel WCL gives customers a sense of wonder, curiosity and the means to develop further curiosity. It's also trying to improve the equity amongst society." (Librarian C).

Learn by fun and play:

Fun and play was a reoccurring theme amongst the participants' responses. Almost each response verified that the position of WCL in providing STEAM services and programmes to children was so they could have fun and have a play with the equipment, while at the same time come away learning something:

"We set it up, (electronics and robotics), as an experience and a play time session for them... We took everything out and they would just play." (Librarian A).

Engagement with communities:

Community engagement was a common theme and goal that emerged both in the participants' responses, as well as a theme discussed in literature (Slatter and Howard, 2013).

Librarian F discussed two big outcomes that WCL is trying to achieve through introducing STEAM programmes, which was engaging with communities and

forming relationships with schools. Librarian F discussed how WCL does not have a strong relationship with high schools, tertiary education sector, alternative education providers and home school networks. Librarian F felt offering a wide range of STEAM services was a way for the library to build closer ties with those communities, which has been achieved so far with the offering of outreach services to the Onslow Special Unit, based at Onslow College, Tawa School and the Home Education group. Wellington City Libraries networks have also formed partnerships with community stakeholders and other industries, such as Code Club Aotearoa, Capital E, Makerfaire, and the Makerspace community in Auckland.

"Offering a wide range of STEAM services is one way for us to build closer ties to communities and that has been very important for our longevity and library services as much as anything else, and to ensure our reputation remains positive among those communities… our positioning and reputation within the community places us in an ideal position to be able to provide those educational opportunities to larger groups of people" (Librarian F).

4.3. **Education vs Recreation:**

The responses from the seven participants confirmed they all felt the STEAM programmes and services had a mixture of both educational and recreational components.

"The foundation of our services is educational, but libraries' unique position within communities is recreational" (Librarian G).

The role of the librarian is to facilitate and be a secondary provider of STEAM, not be assigned the role as teacher or educator (Bayek, 2013; Lankes, 2014).

"Librarians are researchers and facilitators. Whether we do that with books or technology, it's no different. The medium has changed" (Librarian A).

They further agreed that they wanted to create an informal learning environment, mostly leaning towards recreation, hence the objective of creating a fun environment:

"It's all very well for us to create lesson plans and run a programme that has specific educational outcomes but if it's not fun, then there's not any point in us doing it… So, with having a recreational focus during our events is deeply important because we need to attract people to come to the library and to attend the event in the first place. We need to promise people that recreational outcome as well" (Librarian F).

At the same time the kids have come away learning something new, which relates to education.

If you're playing with a robot, part of it is learning how to use the robot. You could also say that's an education because once you get use to learning one robot, chances are it's like the next robot you play with. And then you can teach others how to use them. Therefore, the two go hand and hand together" (Librarian A).

While librarians are not trained or qualified educators or teachers, they provide resources or incorporate elements into their delivery of library based services that lean towards a more informal learning style and educating.

"…even though we're librarians, we're not teachers, but in a sense, we're educators, because whatever we pull out of a story is educating, for example, how to behave; how to make friends; how to count; how to say words; how to read colours. It is also recreation focused because we're playing and acting out while singing the songs and telling the stories..." (Librarian B).

Librarian B discussed how libraries can bridge STEAM learning with the home and schools (Bayek, 2013; Dusenbury, 2014; Jamalian, 2018; Roberson, 2015). The role of the librarians at Wellington City Libraries is to provide the resources within a community space outside of school hours in ways that are exciting, engaging and fun, as also noted by Bayek (2013) Libraries, as well as the home and schools can serve as a "touch point", described by Librarian A. which bridges STEAM learning for children, described by Librarian B.

"Libraries are a stepping stone towards knowledge. If you give children the opportunity to have a play with the STEAM resources in the library, when it comes up in a class environment, they have that connection. And schools are always looking at the child making some form of connection, and saying, "Oh, I've done that before, I have a better idea of this". So hopefully we're trying to build a bridge between schools, the libraries and homes" (Librarian B).

An example of an education component is Code Club, which four participants described as having a detailed and structured curriculum of coding and computer programming projects created and designed by Code Club Aotearoa (Code Club Aotearoa, 2019). The Code Clubs at various sites were reported as being successful and a popular STEAM based service for children; every Code Club session at various sites have been fully booked each term, resulting in people having to go on a waitlist or try again the following term.

"We filled our first Code Club in less than ten hours. The programme was totally full and we had to start taking a waitlist... I had run writing workshops, preschool storytime sessions, I had run class visits before, and I had never seen that level of enthusiasm for a single programme that had filled up within ten hours" (Librarian F).

4.4. **Measurement of success:**

Most of the participants felt the STEAM programmes and services were successful, however one participant felt that because STEAM is still in its early stages, there is still a lot work to be determined what is most successful within libraries. The use of the Ozobots robots proved to be a success in two cases during a class visit at one of the South Cluster Libraries run by Librarian C. Librarian C reported the children were engaged and managed to programme the Ozobots to complete a maze with coding skills. The second successful use of the Ozobots resulted in a child's progression, observed by Librarian A. The child used the Ozobot robots, then learnt how to use Scratch, (computer programming) at Code Club and finally both into a singular project.

Six participants reported the Code Clubs being fully booked each term, where people had to go on a waitlist and enrol in the following term. One participant (Librarian F) commented how Code Club at a West Cluster Library was full ten hours after it was advertised. One session held at a North Library on a Saturday afternoon, was reported as being successful and resulting in people coming back and expressing an interest to learn more. Code Club, at a South-East Cluster Library was introduced at the beginning of 2019 and during its first term was fully booked.

There were reports from two participants, (Librarian A and C), of a high attendance of children coming regularly to Crafterschool.

Other measurements of success included:

Attendance:

Two participants, (Librarian E and F), mentioned attendance was a measure of success because it served as an indicator of the level of interest, and possibly the level of need there is for a programme. Librarian F commented how attendance doesn't always reveal success in terms of whether a programme might work better at a different site, location and time.

“A year or two ago, we did a demo of the NAO robots. The kid’s area, where we did the demo, was packed! There was a huge crowd of kids” (Librarian E).

Engagement:

Most of the participants reported engagement as being a measure of success. Whole Child Education (2015) claims “Students who are engaged and connected… demonstrate increased academic achievement, attendance rates, and participation in activities” (Whole Child Education, 2015).

“Seeing the kids totally engaged is a measure of success. They want to be there. They’re not bored. I don’t think at any point, I heard the children say they were bored” (Librarian B).

Librarian A also provided an example of a successful STEAM programme that resulted in children being engaged:

“You can tell if you’re running a successful programme how engaged the kids are, which was what happened with the Onslow Special Unit. These kids called spades, spades. They didn’t beat about the bush if they found something boring. They would say, “This is boring, we want to do something else”. We didn’t get that feedback from them which were a good sign” (Librarian A).

Feedback:

Participants reported that feedback from customers was another measure of success. Examples of feedback collected ranged from customers talking to staff, filling out feedback forms, posting comments on social media platforms, emails sent to staff and management about what they thought about the events. One participant, (Librarian F), reported how the West Cluster network sends feedback on all CYA programmes every month from children and parents who

attend programmes at West Cluster libraries. Librarian F further reported the feedback ranged from comments such as, *“It was very fun”, “My child wouldn’t stop talking about it once we got home*”, to *“this worked well, but could have worked at a different time”, “Would you consider doing this programme at my child’s school”.*

Librarian A reported how students and teachers from the Onslow Special Unit group expressed thanks and positive feedback about the STEAM programmes, which further resulted in “thank you” cards.

Two participants (Librarian F and G), also raised the importance and the need for feedback from staff on evaluation of programmes and expressed a wish to see more of that approach. Both librarians expressed a desire for a more formal approach of measuring success, for example regular surveys.

“I would like to see more of it come through the staff because from certain groups of staff, … I never hear anything and it’s very difficult to evaluate programmes from sites where I don’t get any feedback, because I can look at numbers, but it only gives me part of the picture and what is most useful for me is what arises out of conversations with the staff members and with patrons as they attend.” (Librarian F).

Preparation and knowledge of resources:

As mentioned in the section, *Goals and objectives*, Librarian C, talked about how preparation and knowledge of the resources being a measure of success, by using the example of a STEAM themed class visit where the librarian set the children a challenge of programming the Ozobots to complete a maze. Librarian C reported:

“I did a lot of trial and error with the equipment to figure out what was going to work and the most reasonable to achieve within an hour, something I felt I could

easily train others to use. I simplified the programme to fit within the time frame of the class visit and on the suggestions, which was on the Ozobot website. We thought very carefully about the two class visits we selected to trial it with, because we knew they would be active and engaged, and that the teachers were also behind the kids getting this experience as well. So, we knew the two classes were most likely to get a good result during the first try."

Librarian C further reported that the class visit was successful. The children could create their own maze and programme the Ozobot to complete the maze successfully.

4.5. **Issues and challenges:**

Participants reported significant issues and challenges based on their own experiences, which picked up on many of those noted in the literature (Curiosity Commons, 2017; Greene and Groenendyk, 2018; Lankes, 2014; Li and Todd, 2019; Mahar, 2018; Pope 2018; Slatter and Howard, 2013).

Staff:

Shortage of staff and STEAM professionals was reported as an issue at Wellington City Libraries, which also links to similar issues documented in other research (Curiosity Commons, 2017; Li and Todd, 2019; Moorefield-Lang, 2015; Pope, 2018).

"With staff skill, there are some staff members that don't possess the same skill set when it comes to technology, digital skills and STEAM knowledge" (Librarian E)

Staff confidence and lack of experience with STEAM equipment was reported as a challenge, as reported in Pope's (2018) research.

" Confidence and experience with the stuff is the biggest obstacles we've had and it leads to mistreatment of the gear. And this stuff isn't cheap. If you mistreat a bot, then you're down a bot" (Librarian A).

Librarian F mentioned the need for more staff to get involved in the planning and delivery of STEAM services as it could help with existing capacity issues:

*"One of the major problems of the way our library system operates is having a large number of staff who are directly delivering services. That's not a problem, it's great to have a lot of staff who is directly delivering services but on the planning and evaluation and strategic, there's only ******** and myself, who work in the children's space. That is a problem because there are only two of us and there are not enough hours in a day or days in the week to plan and deliver everything…" (Librarian F).*

Librarian D brought to light the issue of the closing of the Central Library (due to earthquake risk) and the impact it has had on staff, especially regarding planning of services and programmes:

"Staffing is a big issue. Since the closing of the Central Library, we haven't had the time or motivation to doing anything big because our job is not steady and we're constantly moving around various branches, (I currently work between four branches). It's hard to find a steady place to learn and prepare for any projects" (Librarian D).

Participants also reported that there is still shortage of staff and professionals in the STEAM fields and that there is some resistance from other staff members towards embracing STEAM. The staff "*don't see these kinds of programmes and services being part of the library's mission"* (Librarian F), and STEAM being viewed as a *"gimmick"* (Librarian C), not only by other staff members, but also by patrons. Librarian G discussed an early challenge with STEAM was *"recognition from upper management that STEAM is a service direction".* This

illustrates similar issues concerning shortage of staff and resistance to STEAM reported in other literature (Curiosity Commons, 2017; Greene and Groenendyk, 2018; Moorefield-Lang, 2015; Slatter and Howard; 2013) and criticism of STEAM (Hacker, 2016) of being another "fad" (Wujick, 2013) or "elitist" (Runge, 2013).

"One of the biggest challenges is staff and customers do not understand why STEAM has a place in libraries. There is this concept that it's a gimmick, where we are getting these "toys" for people to play with, and the people take nothing away from the experience. The challenge is about changing that perception." (Librarian C).

Resourcing:

The issue of resourcing was mentioned by participants, particularly where library sites have limited equipment.

"It is very challenging if you want to do a cohesive project and you have limited access to resources. You have to make do with what you have" (Librarian D).

There were also reports of problems with logistics including transporting of material, especially if it is fragile. This relates to issues brought up in Greene and Groenendyk's (2018) research, and further mentioned by Librarians A and F. Librarian A mentioned the issue of transportation of the gear going from site to site, lack of space within the vehicle to hold the bins that the gear goes in, vehicle availability, and if they use a private car, whether the gear is insured.

Funding:

Funding and budget were discussed as universal and common issues and challenges in public libraries. Participants reported that purchasing robotics, equipment, resources and technology could be expensive. Please refer to

Appendix D and E for a summary of the inventory of the robotics and technology in the makerkits and the cost of purchasing the robotics and electronics.

"… Not only do you need a budget to purchase the technology and equipment, but also to maintain it or replace it because otherwise in a couple of years later it could break or be obsolete" (Librarian E).

Technology:

Participants reported issues with technology and mentioned similar issues reported in Pope's (2018), research such as equipment not working, shortage of equipment, equipment maintenance and technology updates (Pope, 2018).

Wifi connection was frequently reported as being a problem. Because some of the devices and electronics require a wifi connection, it can be an issue when the existing wifi either doesn't connect or doesn't have a strong enough connection to enable the devices to work:

"I know when we had a VR day here, during the school holidays, getting a strong enough wifi signal was a problem for some of the headsets. Most of the VR programmes are supposed to run without wifi, but there are some headsets that will automatically try to find a wifi signal, and the programme will pause when the signal is lost, and then it must restart." (Librarian C).

When the wifi and internet network goes down, it presents further challenges, especially if staff are running a STEAM programme that requires internet and wifi connections:

*"I remember the absolute sinking feeling when we had our first code club, the entire wifi network went down at ******* Library and we had sixteen kids turn up*

to participate in the first session and we had to get something together for them and that's an issue across all the sites" (Librarian F).

Technology obsolescence:

Two participants raised the issue of technology obsolescence as an issue of concern, where WCL must replace devices that become obsolete and cannot be supported by the software that is needed to be able to run.

"…our equipment, it has moved on through several stages, and we're still working with the older model. If we want to be tech savvy, then we should be upgrading and updating by buying newer models… we don't have the money to keep buying and implementing the updates all the time" (Librarian B).

This raises further challenges in cost and budget. At least two participants felt there was a need for WCL to build into financial planning a technology obsolescence budget so that material could be replaced when it gets out of date or is broken.

"… not only do you need a budget to purchase the technology and equipment, but also to maintain it or replace it because otherwise a couple of years later it could break or be obsolete (Librarian E).

Maintenance:

Maintaining the STEAM equipment, especially the electronics were reported as an issue in terms of breakage and repairs. There were reports of two Ozobots breaking. One VR headset was damaged by a staff member who, not experienced in handling the equipment, left the VR headset facing up towards the sun which damaged the lens. One of two NAO robots' parts had been broken due not been handled correctly and continuous use.

Two participants (Librarian A and D), mentioned there was one staff member involved in the STEAM projects and maintenance at the Central Library. This staff member then acquired a position out at the North cluster libraries and is unavailable to maintain the equipment. Therefore, most of the equipment is not getting the maintenance and care it needs.

"*You're always going to have maintenance issues with the technology. For example, we had two NAO robots at the beginning and now we are down to one robot, because parts have broken and other parts have stopped working" (Librarian E).*

4.6. **Central Library Closure:**

While interviewing one participant, the issue of the Central Library closure in March 2019 was raised which presented issues and challenges not only to the delivery of STEAM services, but housing collections and hosting events. Pop up library services are available to continue the Central Library services, however space to deliver STEAM services has now become an issue. The Central Library served as a space and community hub for most STEAM related events, for example the Beyond the Page literary festival, which could cater for hundreds of people.

"Lack of space is a challenge. The Central Library was the space for the STEAM and Beyond the Page events and we don't have that anymore" (Librarian D).

The closure of the Central Library has presented further problems because the WCL network no longer has the space to host large events.

"We don't have the space to cater for hundreds of people. The branches are different in size and shape, but don't have the same amount of space that the Central Library had" (Librarian D).

The participant also reported that Central Library staff didn't have the time or motivation to plan any projects, because their *"job was not steady"* (Librarian D), and they had to *"move between various branch locations"* (Librarian D).

"*On many levels, this has affected many people. Other things now have taken priority where staff doesn't get the chance or the opportunity to engage and take part in other projects, for example, STEAM related projects" (Librarian D).*

4.7. **Waitohi Library and future makerspace:**

WCL currently does not have a makerspace or a learning lab. However, this will change when a new library opens in Johnsonville called Waitohi.

"I feel STEAM hasn't come into full fruition, especially in light of all that has happened, for example we don't have a makerspace or a learning lab, at least until the new Johnsonville branch opens which will have a makerspace" (Librarian D).

It is planned for Waitohi to have a makerspace which will include a 3D printer, a laser cutter, makerkits that will be on display.

"We also have a new library opening in Johnsonville, which will serve as either a second or alternative Central Library hub. There will a lot of resources and staffing drawn to that, not to mention the pop libraries opening up around the city." (Librarian D).

4.8. **Does STEAM have a place in libraries:**

During the interviews, the participants were asked a sub-question "*is there anything else you would like to say about STEAM?"* The participants felt that STEAM is becoming a very important service within the profession and

libraries (Librarian A and G*); "STEAM is a real growth area for libraries"* (Librarian F). Another participant (Librarian B) felt STEAM had long been in WCL's existing services and programmes without realising it.

Librarian A explained their perspective of its importance:

"It's definitely becoming more important, especially now everyone has devices, like smartphones and so on, which is trying to normalise this stuff in society... Things that are a part of STEAM are slowly starting to make their way into everyday life. Therefore, this is a good way of getting people involved and excited about technology… It's part of what we do, which is furthering people's knowledge. And that's what we're here for" (Librarian A).

Participants also commented on how STEAM presents opportunities to extend their traditional role and form partnerships, potentially with education communities:

"The other aspect of STEAM education is what support we can provide to our school community. The digital curriculum is mandatory as of next year, so we're increasingly getting enquiries from schools because they have heard we have a makerspace specialist, we have robotics, and they want to tap into what we have…. Whether we provide people expertise or provide physical items, that's an area for development for us, but it's easy to think that schools have what they need but they don't. They're struggling with resourcing and they have the same issues as us with budget, technology and so on. So, that could be a new area for us to expand into" (Librarian G).

One participant, Librarian E, commented how STEAM is not only a service that is catered to children, but also adults.

"While the focus of STEAM has been on children, we hope to have STEAM services that cater for adults. At the Makerfaire, I observed that adults were

drawn and interested in the STEAM resources, as well as children" (Librarian E).

4.9. **Librarians' role in delivering STEAM:**

When asked a sub-question during the interview, *"With STEAM services on the rise in libraries, do you feel the role of libraries and librarians is changing?"* The participants felt, as the literature suggests, that the role of libraries and librarians is changing. Libraries are moving towards being a *"hub for social interaction, activities and a recreational space rather than a book repository that attract and serve a diverse range of users"* (Librarian E). Librarians and library assistants are required to encompass a wider range of skills, for example technology, rather than *"the traditional skillset"* (Librarian F).

"I feel it's worth noting that library professionals have an important role to play as enablers of access to information, allowing people to have access to our space and use our resources to make discoveries, learn and find information; to experience new things, have fun and be creative" (Librarian F).

Further results from the interviews reported that librarians act as facilitators and collaborators (Librarian A and B), by connecting the community to STEAM resources and have made the step to increasing STEAM literacy amongst the community.

"I don't think we are required to be teachers and tech specialists. I feel we should have some knowledge in those areas. I wouldn't see myself as a teacher, in my role. I see myself as a facilitator. I'm there to help people achieve what they want to achieve" (Librarian A).

However, the findings from both the interviews and the literature suggests that while librarians can have some knowledge of education, early childhood, Information and Communication Technology (ICT), and STEAM skills (reported

also by Librarian G), it is not intended that they are professionals in the STEAM field (Bayek, 2013; Lankes, 2014).

"I think it's that mechanism of delivery that's changing which means that librarians constantly need to be up with the play on technology and that require self-motivated education, because you can't always hope to go on a course or go back to study, do library studies, fill and upskill on your knowledge gaps, picking up the micro qualifications throughout their career path to make sure they are able to respond to changing times and stay on the forefront of STEAM education" (Librarian G).

5. **Discussion:**

The aim of this research was to investigate how New Zealand Public Libraries incorporate STEAM Education into Children's services and programmes. I used Wellington City Libraries as the focus of my case study. The findings of this study revealed that WCL is in the experimental stage of delivering STEAM services to children. There was feedback from two participants on how there is no formal or written STEAM based lesson plan that has been documented as an official programme offered to children. There is also no makerspace or learning lab in any branch libraries where children can go and enrich their creativity and innovation skills. At least three participants reported that there was resistance from some library staff and customers for having STEAM related programmes and resources as part of WCL's CYA services. There is also the current situation of the closing of the Central Library that has left a lack of space and staff having no time or motivation to plan and deliver library services, including STEAM. As demonstrated by the case study of Wellington City Libraries and by the literature, it is possible for public libraries to successfully develop and implement STEAM programs by using information gained through assessing community needs, acquiring resources, and forming community partnerships (Roberson, 2015). WCL has been delivering one off and unique STEAM themed programmes and events after school, during school holidays and school visits that have been successful through attendance, engagement and positive feedback from children, their parents and teachers. Results from the interviews and the literature suggest STEAM services for children is another platform to ensure children, their families, schools and various communities have ongoing access to technology that can ensure their needs and success in society for recreational or educational purposes. Further findings suggest that Wellington City Libraries is starting to slowly break away from the traditional lending and book repository service and lean toward serving as community hubs. The roles of librarians have changed and they may be required to have skills and capabilities, especially in ICT, if they are expected to deliver STEAM related programmes and services.

5.1. How STEAM is incorporated at WCL:

The main question the research wanted to investigate was *"How are New Zealand public libraries incorporating STEAM Education into their services and programmes for children?"* Based on the findings collected from the interviews, WCL's experience of developing STEAM services and programmes for children is not dissimilar to the experiences from around New Zealand and overseas documented in the literature.

Most participants answered that STEAM was incorporated into class visits, holiday programmes and after school programmes where multiple learning strands in the fields of science, technology, engineering, arts and mathematics are combined. Examples of programmes that would fit within those strands would be Code Club, Let's Go Lego, Tech Time and so on, (Australian Public Library Association, 2017; Richards, 2017), adopted from similar STEAM models and services already incorporated by existing public libraries both in New Zealand and overseas (Bayek, 2013; Cun, Abramovich and Smith, 2019; Dusenbury, 2014; Koester, 2013). Participants also answered that STEAM was incorporated into another group of programmes and services that have traditional library functions, an example being the class visits programmes, preschool storytime, Baby Rock and Rhyme, STEAM workshops, Crafterschool, craft groups, and so on (Yakman, 2012).

5.2. An informal and inclusive learning environment:

The goal of public libraries is providing members of the community free access to resources and programmes that serve their information needs (Cun, Abramovich and Smith, 2019; Wellington City Libraries, 2017). Public Libraries have always been considered a community based institution because it is free, accessible and welcoming.

Providing STEAM services and programmes creates another opportunity for libraries to continue providing a free community service that, as an added benefit fosters connection, interactions and community building (Bayek, 2013; Dusenbery, 2014; Jamalian, 2018; Slatter and Howard, 2013). Wellington City Libraries' values and strategic goals align with connecting people to information, allowing free access, hence WCL's mission statement:

"Enabling people to achieve their goals through access to library resources; promoting and contributing to lifelong learning and enjoyment" (Wellington City Libraries, 2017, p.1).

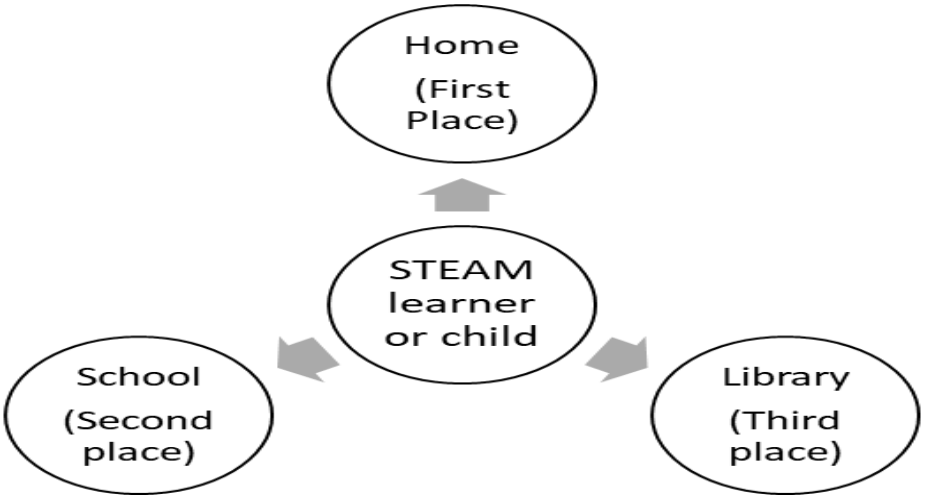
When presented with the question, *"What do you think WCL is trying to achieve through STEAM programmes and services?"* the participants' responses were similar and had common themes. Examples that stood out were creating a free, informal, inclusive learning environment for everyone; encouraging community engagement; access to information and support life long learning, also reflected in the literature (Jamalian, 2018; Li and Todd, 2019; Slatter and Howard, 2013).

The participants' felt that WCL and the STEAM services encompassed both recreational and educational strands. The STEAM programmes and services serves as another recreational and informal educational platform of ensuring the community achieves its goals of access, lifelong learning and enjoyment, as noted by other studies (Bayek, 2013; Cun, Abramovich and Smith, 2019; Li and Todd, 2019), as well as providing opportunities for *"creativity, connection and innovation… to connect our communities to knowledge, wonder and possibilities"* (Wellington City Libraries, 2017, p.1).

5.3. **Libraries as a third cornerstone to STEAM Education:**

Libraries can bridge STEAM learning with the home and schools (Bayek, 2013; Dusenbury, 2014; Jamalian, 2018; Roberson, 2015). The role of the librarians at Wellington City Libraries is to provide the resources within a community space outside of school hours in ways that are exciting, engaging and fun, as also noted by Bayek (2013). Libraries, as well as the home and schools can serve as a “touch point”, described by Librarian A, which builds the bridge, a triangular model or a third cornerstone of STEAM learning for children, described by Librarian B. Such a “triangle model” is like Bayek’s (2013), model framework on “STEM learning in a third place”, which presents a more structured model of the three places (home, school and libraries) where learners can be educated on STEAM topics (p.13).

Triangular STEAM education model:



Bayek (2013) examined if schools and libraries work together, so that as well as sharing the STEAM learning resources, they can support each other in beneficial ways. It could ensure a strong connection between schools and libraries, and make both institutions of learning more coherent for the child while they move between places (Bayek, 2013, p.9). Various Wellington City Libraries networks are already working on ways to bridge the educational and recreational gaps by partnering with schools, (Onslow College and the Special Unit group), home schoolers (Home School Education group), community

stakeholders and other industries, such as Code Club Aotearoa, Capital E, Makerfaire, and Makerspace community in Auckland, develop innovative STEAM based programmes and services. This is an example of what Roberson (2015) describes as remaining responsive to communities' needs by partnering with schools and other community networks to bridge STEAM education gaps and share resources (Bartlett and Bos, 2018; Hopwood, 2012; Jamalian, 2018; Roberson, 2015).

Participants confirmed how WCL wanted to engage with the education community, building on existing relationships with kindergartens and primary schools, high schools, tertiary education sectors; alternative education providers; and home school networks. This has been achieved to date with the outreach visits with Onslow Special Unit group and the Home Education group visiting the library. One participant (Librarian F) confirmed offering STEAM services was one way of building closer ties to those communities.

5.4. **Libraries and the library profession is continually evolving and changing:**

Commentators suggest that the landscape of librarians and the library profession is continually evolving and changing (Bayek, 2013; Koester, 2013) and this is reflected in participant responses:

The digital shift in information and technology over the past decade has changed and transformed the media through which information is published and presented as well as the delivery of programmes and services. This has provided libraries and librarians with the opportunity to re-define and re-design the delivery of information and digital literacy programmes. Public libraries have become places that can play an important role in furthering STEAM education by providing a space for STEAM exhibits and community laboratories for play and informal learning (Bayek, 2013; Jamalian, 2018; Lankes, 2014; Li and Todd, 2019). Lankes (2014) pointed out how libraries can build, provide and even

circulate collections of STEAM resources. However, to create a lasting impact, public librarians need to be engaged, or at least improve on engagement with customers, STEAM training and expertise and encourage other librarians to follow suit.

The results from the interviews support the literature (Bayek, 2013; Lankes, 2014) that suggests librarians can act as facilitators and collaborators (Librarian A and B); and be a secondary provider of STEAM, not be assigned the role of teacher or educator (Bayek, 2013; Lankes, 2014).

As noted, the findings from both the interviews and the literature suggests that although librarians can have some knowledge of education, technology and STEAM skills, (reported also by Librarian G), it is not intended that they are professionals in the STEAM field (Bayek, 2013; Lankes, 2014; Li and Todd, 2019). Dusenbury (2013) suggested that the demand in libraries for STEAM programmes and training is becoming “higher than it has ever been and will continue to increase in the years ahead” (p.18).

The role of libraries and librarians has been about change and adaption. STEAM education presents an opportunity and challenge for libraries to redefine their role and adapt to new trends and technology. The rise of STEAM in public libraries is no different to past trends, such as books, the internet and technology, which were adopted and adapted into service delivery models. STEAM presents a unified approach and opportunity for communities to connect, engage, and learn core skills and literacies in an informal learning environment. Dusenbury (2013) observed that STEAM programmes in public libraries give audiences of all ages more opportunities to learn, to experiment, and to follow individual interests in science and technology (p.18). There is still work to be done, however, in the areas of changing the perception that librarians must know everything, as well as transforming libraries into places of informal learning where people can continuously learn and be curious about the world around them (Jamalian, 2018; Lankes, 2014; Slatter and Howard, 2013).

300061394

6. **Conclusion:**

The study investigates and analyses the perspective of Children and Youth (CYA), librarians on their experiences and opinions of STEAM learning incorporated within CYA services and programmes, for children. This research was a qualitative study that used a phenomenological methodology, by interviewing seven librarians, who work in STEAM and children's services from four public library networks which are a part of Wellington City Libraries, (WCL). The results from the interviews indicate that there have been some elements of STEAM present in existing WCL children and youth services (CYA) such as preschool storytime, Baby Rock and Rhyme and school holiday programmes. Despite making revolutionary advances in their CYA services by introducing robotics, technology; arts and crafts and Lego as a method of incorporating STEAM into their CYA services, STEAM services are still in the experimental stage and require further planning and development, especially in the areas of formal structure and content of programmes. Existing challenges remain in the areas of funding and budget limitation, staffing, technology, and the recent closure of the Central Library. As demonstrated by the case study of Wellington City Libraries and by the literature, it is possible for public libraries to successfully develop and implement STEAM programs by using information gained through assessing community needs, acquiring resources, and forming community partnerships (Roberson, 2015). WCL has achieved this by running CYA programmes and services that incorporate STEAM education that have been proven to be successful with the growing rate of attendance, engagement, and in some cases development and progression with STEAM related skills. WCL plans to expand on formal STEAM programmes and services with the opening of the new Johnsonville Library (Waitohi). It is planned for Waitohi to house a new makerspace area and develop formal lessons that incorporate STEAM strands and elements which can be used by both WCL and other public libraries in New Zealand. Finally, STEAM presents the opportunity for WCL libraries to serve as a community hub for social interaction, activities and a

recreational space, as well as continue to serve as a book repository, and attract and serve a diverse range of users.

6.1. Implications:

The findings of this study will be of interest to public libraries and librarians that work in children and youth services who want to develop improved programmes to effectively deliver STEAM education.

The implications are:

- The potential for public libraries to develop specific policies, practices, and services for children in line with educational guidelines of delivering STEAM education.
- Providing equal amount of access and resources to STEAM related tools, so that equitable access to informal learning is provided for the Wellington region.
- The potential for public libraries to provide services for all members of the community, to stimulate play, have fun and informal learning.

Implications for best practice:

- Findings create awareness of benefits, challenges and strategies for progression that may assist WCL and other New Zealand public libraries in developing and managing STEAM programmes and services for children (Tait, et al, 2016).

- Results from the study highlight the changing role of public libraries and how STEAM programmes and services for children offer unique opportunities for increased community engagement (Tait, et al, 2016).

- Collaborative partnerships with internal and external stakeholders combined with advocacy of new STEAM programs and services contribute to

future-proofing libraries while supporting new directions for library services (Tait, et al, 2016).

6.2. Further research:

This research used nonprobability and convenience sampling to find out how New Zealand public libraries incorporate STEAM (Science, Technology, Engineering, Arts and Mathematics) based services and programmes for children. I used my workplace, Wellington City Libraries, (WCL), as a case study, by interviewing seven staff members working in Children and Youth (CYA) services who run STEAM based services and programmes. Further research in the STEAM based programmes in the future could show whether it works as a core service in libraries and could extend to public libraries in all New Zealand geographical areas.

7. References:

- Alpi, K. M., & Evans, J. J. (2019). Distinguishing case study as a research method from case reports as a publication type. *Journal of the Medical Library Association: JMLA*, 107(1), 1–5. doi:10.5195/jmla.2019.615

- Armknecht, M.P. (2015). *Case Study on the Efficacy of an Elementary STEAM Laboratory School.* Lindenwood University, ProQuest Dissertations Publishing, 2015. 3736747.

- Australian Industry Group. (2015). *Processing STEM Skills in Australia.* Retrieved January 23 2019 from http://cdn.aigroup.com.au/Reports/2015/14571_STEM_Skills_Report_Final_-.pdf

- Bartlett, C., and Bos, L. (2016). *STEAM Around The World.* Retrieved August 14 2019 from https://steamaroundtheworld.wordpress.com/

- Bartlett, C., and Bos, L. (2018). STEAM Around the World: Successfully Incorporating Hands-On Learning and Diversity into Children's Programming, *Journal of Library Administration*, 58(2), 174-182.

- Bayek, J.Y. (2013). *Public Libraries as Places for STEM Learning: An Exploratory Interview Study with Eight Librarians.* National Center for Interactive Learning Education. Retrieved January 23 2019 from https://www.lpi.usra.edu/education/stemlibraryconference/events/Baek_Public_Libraries_STEM_Learning.pdf

- Beauchamp, K. Introducing early years to STEAM in preparation for school, presented at STEAM Education Summit Conference. Auckland, New Zealand, 2019.

- Boodhoo, R., and Purmessur, R.D. (2009), Justification for Qualitative Research in Organisations: A Step Forward. *Journal of Online Education.* 1-7.

Retrieved March 12 2019 from http://www.nyu.edu/classes/keefer/waoe/deeprosh2.pdf

- Boyce, C, and Neale, P. (2006). *Conducting In-Depth Interviews: A Guide for Designing and Conducting In-Depth Interviews for Evaluation Input.* Pathfinder International Tool Series, Monitoring and Evaluation-2. Retrieved March 6 2019 from http://www2.pathfinder.org/site/DocServer/m_e_tool_series_indepth_interviews.pdf

- Boyes, B. "How public libraries contribute to the STEAM agenda." *Real Knowledge Management.* 31 May 2017. Retrieved June 17 2019 from https://realkm.com/2017/05/31/how-public-libraries-contribute-to-the-steam-agenda/

- Bradshaw, M, Things that make you go ummm - misconceptions and cognitive flexibility, presented at STEAM Education Summit Conference. Auckland, New Zealand, 2019.

- Brady, K.B. (2007). Foreword. In *Managing Conflict of Interest: Guidance for Public Entities.* Controller rand Auditor General. Retrieved March 15 2019 from https://www.oag.govt.nz/2007/conflicts-public-entities

- Bryman, A. (2012). *Social Research Methods.* 4th edition. Oxford; New York: Oxford University Press.

- Central Drug Standards and Control Organization. Good Clinical Practices. [Last accessed on 2013 Dec 30]. Available from http://cdsco.nic.in/html/GCP.htm

- Chastain, J. (2014). *A case study of the implementation of a STEAM elementary magnet school in Southwest Missouri.* Southwest Baptist University, ProQuest Dissertations Publishing.

- Civica. (2018). *Public libraries are bridging the gap and stimulating STEAM activities.* Retrieved March 11 2019 from https://www.civica.com/en-au/container---news-library/public-libraries-are-bridging-the-gap-and-stimulating-steam-activities/

- Code Club Aotearoa. (2019). *Code Club projects.* Retrieved August 13 2019 from https://codeclub.nz/page/code-club-projects

- Code Club Aotearoa. (2019). *Home Page.* Retrieved August 13 2019 from https://codeclub.nz/

- Cohen, L., Manion, L. & Morrison K. (2000). *Research Methods in Education.* London: Routledge Falmer.

- Commonwealth of Australia. (2016). *Australia's STEM Workforce: Science, Technology, Engineering and Mathematics.* Retrieved March 14 2019 from https://www.chiefscientist.gov.au/wp-content/uploads/Australias-STEM-workforce_full-report.pdf

- Copley, A.L. (2018). *A Case Study of the Implementation of Co-Teaching in a STEAM Elementary Magnet School in a Midwestern State*. Lindenwood University, ProQuest Dissertations Publishing, 2018. 13811327.

- Core Education. (2019). *STEM: Explanation.* Retrieved January 23 2019 from http://core-ed.org/research-and-innovation/ten-trends/2017/stem/#resources-explain

- Cun, A., Abramovich, S., and Smith, J.M. (2019). An assessment matrix for library makerspaces. *Library and Information Science Research.* 41. 39-47.

- Curiosity Commons. (2017). *Makerspaces: the challenges.* Retrieved August 12 2019 from https://curiositycommons.wordpress.com/makerspaces-the-challenges/

- Denzin, N. K., & Lincoln, Y. S. (Eds.). (1998). *The SAGE handbook of qualitative research.* Thousand Oaks, CA: Sage Publications.

- Dougan, P. (2016). "Students being taught New STEAM concept which mixes science and maths with art" 29 Aug 16*. New Zealand Herald*. Retrieved August 12 2019 from https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11700721

- Dubois, A, and Gadde, L. (2002). Systematic combining: an abductive approach to case research. *Journal of Business Research.* 55 (7) 553-560.

- Dudovskiy, J. (2019). Deductive Approach (Deductive Reasoning). Research Methodology. Retrieved August 14 2019 from https://research-methodology.net/research-methodology/research-approach/deductive-approach-2/

- Dudovskiy, J. (2019). Inductive Approach (Inductive Reasoning). *Research Methodology.* Retrieved August 14 2019 from https://research-methodology.net/research-methodology/research-approach/inductive-approach-2/

- Dugmore, P, Lindop, H and Baruk, B. (2014). *Making the makers: an exploration of a makerspace in a city library.* Retrieved March 11 2019 from https://lianza.org.nz/sites/default/files/Dugmore_P_Making_the_makers.pdf

- Dusenbery, P. B. (2014). *The STEM Education Movement in Public Libraries. Informal Learning Review.* Retrieved January 22 2019 from http://ncil.spacescience.org/images/papers/ILR%20STEM%20Library_FINAL.pdf

- Education Closet. (2019). *What is STEAM?* Retrieved March 8 2019 from https://educationcloset.com/steam/what-is-steam/

- Eger, J. (2015, November 24). *The Congressional STEAM Caucus may turn STEM to STEAM in the reauthorization of ESEA*. Retrieved from August 12 2019 from www.huffingtonpost.com/john-m-eger/stem-may-become-steamoffi_b_8634126.html

- Elliott, S. J., & Gillie, J. (1998). Moving experiences: A qualitative analysis of health and migration. Health & Place, 4(4), 327-339.

- Elsevier. (2015). *Factsheet Conflict of Interest.* Retrieved March 15 2019 from https://www.elsevier.com/__data/assets/pdf_file/0010/92476/ETHICS_COI02.pdf

- Engler, J. (2012) STEM Education Is the Key to the U.S.'s Economic Future U.S. News. Retrieved March 14 2019 from http://www.usnews.com/opinion/articles/2012/06/15/stem-education-is-thekey-to-the-uss-economic-future

- Freeman, S, Intentional teaching – bringing science into awareness in the early years, presented at STEAM Education Summit Conference. Auckland, New Zealand, 2019.

- Gahagan, P.M. (2016). *Evaluating Makerspaces: Exploring methods used to assess the outcomes of public library makerspaces.* (Unpublished doctoral

dissertation [OR] Unpublished master's thesis). Victoria University Wellington: Wellington: New Zealand.

- Ghooi R. B. (2015). Conflict of interest in clinical research. *Perspectives in clinical research*, 6(1), 10-4. Retrieved March 11 2019 from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4314841/

- Greene, D., and Groenendyk, M. (2018). Blurred Lined – between virtual reality games, research and education. IFLA WLIC 2018 – Kuala Lumpur, Malaysia – Transform Libraries, Transform Societies. Retrieved July 14 2019 from http://library.ifla.org/2133/1/075-greene-en.pdf

- Hacker, A. (2016). *The Math Myth: And Other STEM Delusions.* The New Press. New York: USA.

- Hamilton City Libraries. (2019). *The Lab.* Retrieved March 11 2019 from https://www.hamiltonlibraries.co.nz/page/pageid/2145884829/The_LAB

- Hiest, B. (2012). *From Thematic Analysis to Grounded Theory.* Retrieved March 15 2019 from http://www.mermaid.pitt.edu/documents/MERMAID%20GrndedThry%20talk%20HEIST.pdf

- Hopwood, J. (2012). Initiating STEM Learning in Libraries. *Children & Libraries.* 10(2), 53-55.

- Horne, E.J. “What is STEM education?” *Live Science.* 11 Feb 2014. Retrieved March 8 2019 from https://www.livescience.com/43296-what-is-stem-education.html

- Iowa State University. (2019). *Case Studies.* Retrieved September 9 2019 from https://instr.iastate.libguides.com/c.php?g=49332&p=318068

- Jain, A., & Ogden, J. (1999). General practitioners' experiences of patients' complaints: Qualitative study. BMJ, 318, 1596-1599.

- Jamalian, A. "Librarians are Taking the Lead in Defining STEM in Schools". *EDtech Digest.* 7 Aug 18. Retrieved August 5 2019 from https://edtechdigest.com/2018/08/07/librarians-are-taking-the-lead-in-defining-stem-in-schools/

- Jho, H, Hong, O and Song, J. (2016). An Analysis of STEM/STEAM Teacher Education in Korea with a Case Study of Two Schools from a Community of Practice Perspective. *Eurasia Journal of Mathematics, Science & Technology Education,* 12(7), 1843-1862 doi: 10.12973/eurasia.2016.1538a

- Johnston, K. (2018). *Mobile Makerspaces at Christchurch City Libraries.* Retrieved March 11 2019 from https://lianza.org.nz/article/mobile-makerspaces-christchurch-city-libraries

- Jolley, A. "STEM vs. STEAM: Do the Arts Belong?" *Education Week Teacher.* 18 Nov 2014. Retrieved March 14 2019 from https://www.edweek.org/tm/articles/2014/11/18/ctq-jolly-stem-vs-steam.html

- Kajornboon, A. B. (2005). *Using interviews as research instruments*. (Abstract). Language Institute, Chulalongkorn University, Bangkok, Thailand. Retrieved September 13 2019 from https://pdfs.semanticscholar.org/57e1/87565ff9c19fb9d7673b964cd77f485bcab0.pdf

- Koester, A. (2012). "All things STEAM." *The show me librarian."* Retrieved March 16 2019 from https://showmelibrarian.blogspot.com/p/all-things-steam.html

- Koester, A. (2012). *Building STEAM with DIA! Toolkit.* American Library Association: Association for Library Service to Children. Retrieved March 16 2019 from http://dia.ala.org/sites/default/files/resources/150817_BuildingSteamWithDiaToolkit_pages_1.pdf

- Koester, A. (2013). Full steam ahead: Inject art into STEM with hands-on learning. *School Library Journal, 59*(10), 22-25.

- Khoo, E., and Cowie, B. (2018). *Mobile makerspaces as a catalyst for fostering STEAM activities in the community*. Hamilton, New Zealand: WMIER, University of Waikato.

- Lankes, R.D. (2015) *Expect More: Why Libraries Cannot Become STEM Educators. Public Libraries and STEM: A National Conference on Current Trends and Future Directions.* Retrieved July 14 2019 from https://www.lpi.usra.edu/education/stemlibraryconference/events/Lankes_Expect_More_PRINT.pdf

- Laurenson, P. “Why it’s important to take STEM subjects.” *Careers New Zealand.* 22 Jun 2018. Retrieved May 13 2019 from https://www.careers.govt.nz/articles/why-its-important-to-take-stem-subjects/

- Leedy, P. D. and Ormrod, J. E. (2012). *Practical Research: Planning and Design* (International edition; 10th edition). Boston, MA: Pearson Education.

- Leedy, P. D. and Ormrod, J. E. (2015). *Practical Research: Planning and Design* (International edition; 11th edition). Boston, MA: Pearson Education.

- Lepla, R. “Seven ways to make the most of your libraries.” *NZ Local Government Magazine.* 2 Feb 2016. Retrieved March 5 2019 from

https://localgovernmentmag.co.nz/lg-magazine/assets-asset-management/using-library-services/

- Li. X and Todd, R.J. (2018). Makerspace Opportunities and Desired Outcomes: Voices from Young People. *The Library Quarterly.* 89 (4), 316-332.

- Liao, C. (2016). From interdisciplinary to transdisciplinary: An arts-integrated approach to STEAM education. *Art Education*, 69(6): 44–49.

- Lumen Learning. (2017). Writing Effective Interview Questions. Retrieved September 13 2019 from https://courses.lumenlearning.com/ivytech-engl112/chapter/writing-effective-interview-questions/

- Maguire, M., and Delahunt, B. (2017). Doing a thematic analysis: a practical, step-by-step guide for learning and teaching scholars. *All Ireland Journal of Teaching and Learning in Higher Education*, 3, p.3351-14. Retrieved March 14 2019 from http://ojs.aishe.org/index.php/aishe-j/article/viewFile/335/553

- Maher, M. (2017). *Revisioning School Libraries Through Makerspaces*. Retrieved August 12 2019 from http://www.ala.org/acrl/sites/ala.org.acrl/files/content/conferences/confsandpreconfs/2017/MakerspaceorWasteofSpace.pdf

- Marshall, M. N. (1999). Improving quality in general practice: Qualitative case study of barriers faced by health authorities. BMJ, 319, 164-167.

- Miller, R. (2013). *Development of a proposal for a Technology Assessment Report.* Retrieved March 14 2019 from http://rosspmiller.weebly.com/inductive-coding.html

- Ministry of Education. (2019). *Cultural intelligence inspires authentic learning in STEAM at Taita College.* Retrieved August 12 2019 from http://elearning.tki.org.nz/Teaching/Snapshots-of-Learning/STEAM-at-Taita-College

- Ministry of Education of New Zealand. (2019). *STEAM.* Retrieved March 8 2019 from http://elearning.tki.org.nz/Teaching/Future-focused-learning/STEAM

- Moorefield-Lang, H. (2015). Change in the Making: Makerspaces and the Ever-Changing Landscape of Libraries. *TechTrends: Linking Research and Practice to Improve Learning.* 59(3), 107-112.

- Moorefield-Lang, H. (2015). User Agreements and makerspaces: a content analysis. *New Library World.* 116(7/8): 358-368

- Morrison, M.A., Haley, E., Sheehan, K.B. and Taylor, R.B. (2002), "A Qualitative View of the World: Theory and Data Analysis," In *Using Qualitative Research in Advertising.* Thousand Oaks, CA: Sage Publications.

- Murawski, J. (2016) "An argument against emphasis on STEM education". *The Charlotte Observer.* 22 Apr 2016. Retrieved August 15 2019 from https://www.charlotteobserver.com/entertainment/books/article73350382.html

- Noh, Y. (2017). A Study of the Effects of Library Creative Zone Programs on Creative Thinking Abilities. *Journal of Librarianship and Information Science*. 49 (4): 380–96.

- Overbey, T.A., Dotson, D.S., and LaBadie, M.M. (2018) Public Libraries and Higher Education Combining Efforts to Create Quality Stem Children's Programs, *Public Library Quarterly*, 37:1, 21-35.

- Oxford Dictionary. (2019). *Robotics.* Retrieved March 8 2019 from https://en.oxforddictionaries.com/definition/robotics

- Piggot, C. (2018). *Proposal Paper: Maker Carts.* Wellington City Libraries: Wellington, N.Z. 1-6.

- Pope, H. (2018). Incorporating Virtual and Augmented Reality in Libraries. In Virtual and Augmented Reality in Libraries. *Library Technology Reports. 54 (6). 8-11.*

- Rendina, D. “Defining Makerspaces: What The Research Says.” *Renovated Learning.* 2 Apr 2015. Retrieved March 8 2019 from http://www.renovatedlearning.com/2015/04/02/defining-makerspaces-part-1/

- Richards, J. “How Public Libraries Contribute to the STEM Agenda.” I*nternational* F*ederation of* L*ibrary* A*ssociations and Institutions (IFLA).* 26 May 2017*.* Retrieved March 8 2019 from https://www.ifla.org/node/11420

- Roberson, T.L. (2015). “STEM”-ulating Young Minds: Creating Science-Based programming @ your Library, *Journal of Library Administration,* 55(3), 192-201.

- Runge, S. “Pros and Cons of STEM Education.” *Education.alot.* 13 Jun 2017. Retrieved August 12 2019 from https://education.alot.com/k-12/pros-and-cons-of-stem-education--8753

- Saunders, M., Lewis, P. and Thornhill, A. (2012) *Research Methods for Business Students.* 6th edition, Pearson Education Limited.

- Slatter, D. and Howard, Z. (2013). A place to make, hack, and learn: makerspaces in Australian public libraries, *The Australian Library Journal*, 62(4), 272-284.

- Small, C. R. (2018). *Librarians leading change: Informal learning spaces and the interception of public libraries and STEAM.* (Unpublished doctoral dissertation [OR] Unpublished master's thesis). Pepperdine University, ProQuest Dissertations Publishing. Retrieved January 22 2019 from https://search-proquest-com.helicon.vuw.ac.nz/docview/2130617059?accountid=14782

- Tait E et al. (2016) Libraries for the future: the role of IT utilities in the transformation of academic libraries. *Palgrave Communications*. 2:16070 doi: 10.1057/palcomms.2016.70.

- Taylor-Jorgensen, T, Curriculum, Pathways & Progress in the 21st Century and Beyond, presented at STEAM Education Summit Conference. Auckland, New Zealand, 2019.

- Thomas, D. R. (2006). A general inductive approach for analyzing qualitative evaluation data. *American Journal of Evaluation*, 27(2): 237-246.

- Troxel, G. “Public Libraries provide opportunities for STEM Learning.” *Informal Science.* 1 Jan 2016. Retrieved March 16 2019 from http://www.informalscience.org/news-views/public-libraries-provide-opportunities-stem-learning

- University of Waikato. (2018). *Mobile makerspaces as a catalyst for fostering STEAM activities in the community.* Retrieved March 5 2019 from https://www.waikato.ac.nz/wmier/projects/mobilemakerspacesasacatalystforfosteringsteamactivitiesinthecommunity

- Wellington City Libraries. (2017). *Libraries Customer Charter*. 1-9. Retrieved August 4 2019 from http://www.wcl.govt.nz/about/services/customer-charter.pdf
- Westlake Girls High School (2019). *STEAM*. Retrieved August 12 2019 from https://www.westlakegirls.school.nz/steam-2/
- Whole Child Education. (2015). *Engaged.* Retrieved August 15 2019 from http://www.wholechildeducation.org/about/engaged
- Wikipedia. (2018). *Code Club.* Retrieved March 8 2019 from https://en.wikipedia.org/wiki/Code_Club
- Wujck, A. “The Teacher Report: What Are the Pros and Cons of STEM Education?” *We Are Teachers.* 27 Mar 13. Retrieved August 12 2019 fromhttps://www.weareteachers.com/the-teacher-report-what-are-the-pros-and-cons-of-stem-education-2/
- Yakman, G. (2008). STΣ@M education: An overview of creating a model of integrative education. *Pupils Attitudes towards Technology 2008 Annual Proceedings*. Netherlands.
- Yakman, G. (2012). Recognizing the A in STEM Education. *Association for Middle Level Education*. 16(1), 15-16.
- Yakman, G., & Lee, H. (2012). Exploring the exemplary STEAM education in the U.S. as a practical educational framework for Korea. *Journal of the Korean Association for Science Education*, 32(6), 1072–1086.
- Yin, R. (1994). *Case study research. Design and methods*, Sage Publications, Thousand Oaks.

300061394

- Zaidah, Z. (2007) Case Study as a Research Method. *Jurnal Kemanusiaan*, 9, 1-6.

8. **Bibliography:**

- Allen, S. & Peterman, K. (2019). Evaluating informal STEM education: Issues and challenges in context. In A. C. Fu, A. Kannan, & R. J. Shavelson (Eds.), *Evaluation in Informal Science, Technology, Engineering, and Mathematics Education. New Directions for Evaluation*, 161, 17–33.

- American Libraries Association. (2016). *Definition of a Library: General Definition.* Retrieved March 8 2019 from https://libguides.ala.org/library-definition

- American Library Association. (2019). *Careers in Public Librarianship: Public Librarians Talk About the Profession*. Retrieved August 14 2019 from http://www.ala.org/pla/resources/tools/careers/publiclibrarians

- American Library Association. (2019). *Me, a librarian?* Retrieved August 14 2019 from http://www.ala.org/educationcareers/careers/librarycareerssite/mealibrarian

- Barcelona Field Studies Centre. (2019). *Qualitative Research in Geography using Coding Analysis.* Retrieved March 14 2019 from https://geographyfieldwork.com/CodingAnalysis.htm

- Batten, L. (2015). *Notes for Ethics Committees.* Massey University of New Zealand. Retrieved March 11 2019 from https://www.massey.ac.nz/massey/fms/Human%20Ethics/Documents/Ethics%20Notes%20-%20Conflict%20of%20Interest.pdf?277B958AC460CBD2124A224C751AF5C9

- Braun, V. & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77-101.Christchurch City Libraries. (2019). *Makerspaces and 3D Printing.* Retrieved March 8 2019 from https://my.christchurchcitylibraries.com/maker-space/

- Careers New Zealand. (2017). *Librarian: Kaitiaki Pātaka Pukapuka.* Retrieved August 14 2019 from https://www.careers.govt.nz/jobs-database/arts-and-media/culture-heritage/librarian/

- Clarke, V. & Braun, V. (2013) Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. *The Psychologist,* 26(2), 120-123.

- Collins Dictionary. (2019). *Librarian.* Retrieved March 11 2019 from https://www.collinsdictionary.com/dictionary/english/librarian

- Dougan, P. “Students being taught New STEAM concept which mixes science and maths with art.” *New Zealand Herald.* 29 Aug 16. Retrieved March 8 2019 from https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11700721

- Dowdell, L. (2018). *How Public Libraries support the Information Needs of homeless people: A New Zealand Public Libraries Case Study.* (Unpublished doctoral dissertation [OR] Unpublished master's thesis). Victoria University Wellington: Wellington: New Zealand.

- Dowdell, L. (2018). *INFO 580 Research Project Research Proposal: How Public Libraries support the Information Needs of homeless people: A New Zealand Public Libraries Case Study.* Victoria University Wellington: Wellington, N.Z., 1-14.

- Government of Canada. (2018). *Panel on Research Ethics.* Retrieved March 11 2019 from http://www.pre.ethics.gc.ca/eng/policy-politique/initiatives/tcps2-eptc2/chapter7-chapitre7/

- Hadenbrook, J. “Making Sense of Makerspaces: Academic Library Staff Response to a Makerspace.” *Mr. Library Dude.* 4 Dec 2017. Retrieved March 6 2019 from https://mrlibrarydude.wordpress.com/2017/12/04/making-sense-of-makerspaces-academic-library-staff-response-to-a-makerspace/

- Hammarberg, Kirkman, M, and de Lacey, S. (2016). Qualitative research methods: when to use them and how to judge them, *Human Reproduction*, 31, Issue 3(1), 498–501, Retrieved March 8 2019 from https://doi.org/10.1093/humrep/dev334

- Jones, T.K, Patel, S, Shailan, P and Smith, J, Establishing STEAM learning for a diverse and inclusive school, presented at STEAM Education Summit Conference. Auckland, New Zealand, 2019.

- Lo, B, and Field, M.J. (2009). *Conflict of Interest in Medical Research, Education, and Practice.* Washington (DC): National Academies Press.

- Makerspaces.com. (2018). *What is a Maker Space?* Retrieved March 8 2019 from https://www.makerspaces.com/what-is-a-makerspace/

- Mwaniki, P. (2018), "Envisioning the future role of librarians: skills, services and information resources", *Library Management*, Vol. 39 No. 1/2, pp. 2-11. https://doi.org/10.1108/LM-01-2017-0001

- New Zealand Government Procurement. (2019), Managing conflicts of interest and confidentiality. Retrieved March 15 2019 from https://www.procurement.govt.nz/procurement/guide-to-procurement/plan-your-procurement/managing-conflicts-of-interest-and-confidentiality/
- Oxford Dictionary. (2019). *Education.* Retrieved March 8 2019 from https://en.oxforddictionaries.com/definition/education
- Páez Grosso, J.A. (2017). *Worksheets Based on Vocabulary Learning Strategies to Enhance Students' Writing.* Universidad Externado de Colombia: Bogotá D.C., Colombia. Retrieved March 14 2019 from https://core.ac.uk/download/pdf/159846981.pdf
- Patterson, K, Involving the arts in STEAM, presented at STEAM Education Summit Conference. Auckland, New Zealand, 2019.
- Rowlands I et al. (2008) The Google generation: The information behaviour of the researcher of the future. *Aslib Proceedings*; 60 (4): 290–310.
- Shuttleworth, M. (Apr 1, 2008). Case Study Research Design. Retrieved Sep 06, 2019 from https://explorable.com/case-study-research-design
- Snieder, R. & Larner, K. (2009) The Art of Being a Scientist: A Guide for Graduate Students and their Mentors, Cambridge University Press.
- Stenhouse, L. (1981). Using case study in library research. *Social Science Information Studies.* 1, pp 221-230
- Stottok, B.O., Bergaus, M. N., and Gorra, A. (2010). *Colour coding: an alternative to analyse empirical data via grounded theory.* Retrieved March 14

300061394

2019 from http://stottok.rollsport-nuernberg.de/2011-03-13_ECRM_Colour_Coding.pdf

- Sutton, J., & Austin, Z. (2015). Qualitative Research: Data Collection, Analysis, and Management. *The Canadian journal of hospital pharmacy*, *68*(3), 226-31.

9. Appendices:

9.1. Appendix A: Participant Information Sheet:

An investigation and an evaluation of how public libraries incorporate STEAM Education into children and youth services and programmes.

INFORMATION SHEET FOR PARTICIPANTS

You are invited to take part in this research. Please read this information before deciding whether or not to take part. If you decide to participate, thank you. If you decide not to participate, thank you for considering this request.

Who am I?

My name is *Kate McLachlan* and I am a Masters student in *Information Management* at Victoria University of Wellington. As part of the completion of my Master of Information Studies, this study is designed to investigate and evaluate how public libraries incorporate science, technology, engineering, arts and mathematics, (STEAM), into children and youth services and programmes.

What is the aim of the project?

The focus of my research is to gain the perspective of Children and Youth (CYA), librarians on their experiences, thoughts and opinions of STEAM learning incorporated within CYA services and programmes, for children. The outcome of this research will provide better knowledge and understanding of how New Zealand Public Library STEAM services and programmes can be improved, focusing on further development of STEAM and library policies, practice and services to encourage more library users, (children and their parents) to develop the knowledge and skills vital to their growth and contribution in the global work economy.

300061394

This research has been approved by the Victoria University of Wellington Human Ethics Committee #27463.

How can you help?

You have been invited to participate because you have knowledge of CYA and STEAM services from a strategic and operational viewpoint).

Interviewing you will enable me enables me to gather data on the perceptions, thoughts, experiences, and expectations of STEAM programming and services for children at Wellington City Libraries. If you agree to take part, I will interview you at the location we both agree to. I will ask you questions about STEAM programmes and services for children and young adults. The interview will take 30 minutes to 1 hour. I will audio record the interview with your permission and write it up later. You can choose to not answer any question or stop the interview at any time, without giving a reason. You can withdraw from the study by contacting me at any time. If you withdraw, the information you provided will be destroyed or returned to you.

What will happen to the information you give?

This research is confidential. You will not be named in the final report but your organisation will be named and you should be aware that in small project your identity might be obvious to others in your community.

All material used and collected will be kept confidential, and will be viewed only by myself and my supervisor Anne Goulding. The research report will be submitted for marking to the School of Information Management, and subsequently deposited in the University Library.

What will the project produce?

The information from my research will be used in Masters Report, with the possibility of being used in future academic publications and conferences.

300061394

If you accept this invitation, what are your rights as a research participant?

You do not have to accept this invitation if you don't want to. If you do decide to participate, you have the right to:

- choose not to answer any question;
- ask for the recorder to be turned off at any time during the interview;
- withdraw from the study up to two weeks after the interview;
- ask any questions about the study at any time;
- receive a copy of your interview recording;
- receive a copy of your interview transcript;
- read over and comment on a written summary of your interview.

If you have any questions or problems, who can you contact?

If you have any questions, either now or in the future, please feel free to contact either:

Student:
Kate McLachlan
mclachkate@myvuw.ac.nz

Supervisor:
Anne Goulding
Acting director of Information Studies Programme
School of Information Management
+64-4-463 5887.
anne.goulding@vuw.ac.nz

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research you may contact the Victoria University HEC Convenor: Dr Judith Loveridge. Email hec@vuw.ac.nz or telephone +64-4-463 6028.

300061394

Appendix B: Participant Consent Form:

An investigation and an evaluation of how public libraries incorporate STEAM Education into children and youth services and programmes.

CONSENT TO INTERVIEW

This consent form will be held for *2* years.

Researcher: Kate McLachlan, School of Information Management, Victoria University of Wellington.

- I have read the Information Sheet and the project has been explained to me. My questions have been answered to my satisfaction. I understand that I can ask further questions at any time.
- I agree to take part in an audio recorded interview.

I understand that:

- I may withdraw from this study at any point before 1st July, and any information that I have provided will be returned to me or destroyed.
- The identifiable information I have provided will be destroyed on 21st October 2021.
- Any information I provide will be kept confidential to the researcher and the supervisor.
- I understand that the results will be used for a Masters Research project report and/or academic publications and/or presented to conferences.
- My name will not be used in reports, nor will any information that would identify me.

300061394

- I would like to receive a copy of the final report and have added my email address below. Yes □ No □

Signature of participant: _____

Name of participant: _____

Date: _____

Contact details: _____

Appendix C: Participant Interview Questions:

An investigation and an evaluation of how public libraries incorporate STEAM Education into children and youth services and programmes.

Researcher: Kate McLachlan, School of Information Management, Victoria University of Wellington.

Interview Questions:

1. Can you please tell me a little about your involvement with STEAM at Wellington City Libraries, (WCL)?
2. How do WCL incorporate STEAM Education into their services and programmes for children?
3. What STEAM programmes and services are currently being offered at WCL?
4. What do you think WCL is trying to achieve through STEAM programmes and services?
5. Do the STEAM based programmes and services at WCL have an education or recreation based focus?
6. Do you think STEAM programmes and services are successful? Can you please give me an example of something that stood out for you?
7. How do you evaluate the outcomes of success of the STEAM programmes and services?
8. What are the issues, challenges and obstacles that WCL has faced when delivering STEAM programmes and services?
9. Is there anything else you would like to say about STEAM?

Appendix D:

List of robotics and electronic equipment in each makercart housed at various WCL networks.

Makercart inventory:

- 2x iPad mini
- 3x Sphero SPRK+
- 3x Ozobot Evo
- 1x Dash/Cue
- 1x mBot with rechargeable battery
- 1x Ozmo base kit
- 1x Coding with Awbie pack
- 1x Makeblock Neuron inventor kit
- 3x Let’s go code
- 2x Snap Circuits
- 1x Oculus GO VR headset
- 1x USB charge hub

300061394

Appendix E:

Cost of robotics housed in the makercarts.

Robotics Cost:

- Ozobot Bit &Evo: $95 - $188
- Edison: ~$110 (including accessory kit)
- Cue & Dash: Discontinued now, but were around $200
- Sphero SPRK+: $195
- mBot: $120
- Dobot Magician: usually ~$2000 - $2500
- NaoQi robots: ~$14k - $15k each

300061394

Name: Kate McLachlan.

Word Count: Approximately 13, 992 words (Excluding title page, contents, abstract, acknowledgements, references, bibliography and appendices).