Motivations and prospects for the adoption and implementation of virtual reality in Aotearoa New Zealand's public libraries

by

Yaktrina (Katia) Grodecki

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Abstract

Research problem: The motivations of public libraries in New Zealand (NZ) to adopt and offer virtual reality (VR) programmes to their users; the ways in which the libraries offer VR; and the prospects of future VR programming.

Methodology: The staff of nine public libraries in NZ that offer VR took part in semi-structured interviews. The qualitative data was coded and analysed using thematic analysis.

Results: This research offers an overview of the implementation of VR in NZ's public libraries, including challenges and future opportunities. The libraries introduced VR in order to provide their users equitable access to the technology. Although the libraries offered both games and experience-based apps, several participants expressed their goals of developing VR content and offering learning-focused programmes. The greatest setback for the libraries has been the COVID-19 pandemic, which restricted the ability of the libraries to deliver in-person VR programmes. While several libraries found ways to adapt to these changes, others waited for the easing of restrictions to return to their regular programming.

Implications: The experiences of the participating libraries provide insights for their counterparts that offer VR. For libraries that are contemplating the adoption of the technology, the results comprise an overview of opportunities and challenges to consider.

Keywords: Virtual reality (VR), digital inclusion, public libraries

1. Introduction

Virtual reality (VR) is a growing technology that has become more accessible to consumers in recent years. With the use of a stand-alone headset or a headset connected to a computer or game console, we are invited into a virtual world that immerses us in experiences such as games, roller coaster rides, museum visits, or explorations of travel destinations. In addition to a more immersive version of video game play, VR also offers opportunities for both formal and informal learning. Among the different public spaces in which VR has been introduced over the past few years are libraries. Through the overarching goal of digital inclusion, public libraries strive to offer access for their users to new technologies, including VR (Bertot et al., 2016; Dahya et al., 2021; Hartnett et al., 2020; Pope, 2018).

In Aotearoa New Zealand (NZ), several public libraries introduced VR programmes in the recent years (Christchurch City Libraries, 2021; Ranford, 2021; Selwyn Libraries, n.d.). Research into VR in libraries has been done in overseas countries, primarily in academic libraries, with results that discuss the challenges of the implementation of the technology, the perceptions of library staff and users, and opportunities for future developments (Cook et al., 2019; Greene & Groenendyk, 2021; Suen et al., 2020). Other literature examines the perceptions of library users toward VR library programming and available content (Dahya et al., 2021), as well as the prospects of VR for learning purposes (Sample, 2020; Shackelford et al., 2019).

Based on such literature, the researcher sought to learn in more detail the nuances of the implementation of VR in NZ's public libraries. The problem of this research is concerned with the motivations of public libraries in NZ to adopt and offer VR programmes to their users; the ways in which the libraries offer VR; and the prospects of future VR programming. The objectives of this research were to identify the commonalities and discrepancies among the successes and challenges that the libraries have faced in the initial introduction of VR and

through the subsequent stages; what lessons they learned in the process; and their future prospects.

The researcher seeks to address the following research questions (RQs):

RQ 1: What are the rationales and motives behind the introduction and implementation of VR in NZ's public libraries where VR is currently used?

RQ 2: What discrepancies exist between the planned and current application and usage of VR in public libraries, and how will the current experience affect plans for future application?

RQ 3: What are the challenges, prospects and opportunities for future uses of VR in public libraries in NZ?

The data was gathered through semi-structured interviews with nine participants who manage VR programming in their respective libraries. Thematic analysis was used to analyse the data through inductive coding to generate the findings. This research strives to provide insights for libraries that are currently contemplating or planning the adoption of VR. For the libraries that have been early adopters of VR, this research provides data from other libraries to inform strategic decision-making for future implementation.

2. Literature review

VR technology provides users with virtual experiences that can be either entertaining, educational, or both, allowing users to play video games by 'stepping into' another world or learn a new manual skill through a simulated practice (Dahya et al., 2021; Pope, 2018; Smith, 2019). The introduction of VR in public libraries is an issue that must be explored in order to better understand the challenges and opportunities that affect VR adoption in this sector. However, it is important to note that there is not enough existing research on VR that has been conducted specifically in public libraries. The literature focuses primarily on academic libraries, with some mention of public libraries. The existing literature on VR implementation in libraries

offers results of studies pertaining to the general access and use of VR and the related challenges; discusses the differences between VR in libraries for purposes of entertainment versus learning; and provides insights into library users' perceptions of VR.

2.1 Educational frontiers of VR

Before delving into a discussion of the types of access and use of VR in libraries as presented in existing literature, it is important to understand today's contexts of the educational opportunities of VR. VR is continuing to undergo testing in the study of such subjects as biology, anatomy, and archaeology, allowing learners to study 3D models in VR instead of using more traditional online platforms (Erolin et al., 2019; Real-world opportunities with virtual reality, 2021; Shackelford et al., 2019). Gorman et al. (2021) discuss the usage of VR in delivering cooking safety lessons to school children, noting that VR can be an effective platform to use due to the availability for the programme for access by students outside the school environment via virtual learning and the availability of the lessons for students who have missed or would like to revisit a lesson (Gorman et al., 2021).

In many areas of learning, the usage of VR can be economical, offering students an opportunity to learn by using a virtual simulation instead of training in the field (Cooper et al., 2019; Shackelford et al., 2019). While VR can serve as a platform for virtual learning that replaces existing physical environments due to financial and practical implications, it can also be utilised for conceptual learning about space design – for example, in the design of library spaces (Calvert, 2019).

In addition to formal learning opportunities, focused community-based learning that utilises VR can be valuable to users, such as in the case of learning to understand dementia through first-person interactive virtual experiences in order to foster more tolerant and inclusive communities (Sari et al., 2020), immersive learning and therapy for neurodiversity (Boyd et al., 2018; Soccini et al., 2020), or with visual art sessions for stroke rehabilitation (Marylyn et al.,

2021). Despite offering suggestions for improvement of the technology, many participants in the studies discussed in the literature have found the educational VR experiences to be entertaining and engaging because of their perception of the experiences as realistic (Erolin et al., 2019; Gorman et al., 2021).

Singh et al. (2020) and Wang (2022) found that healthcare patient education and therapy using VR can be of particular benefit during the COVID-19 pandemic, when in-person interaction may be deemed unsafe due to insufficient or inadequate personal protective equipment, or due to related restrictions. In addition to patient education, the technology can be used for the training of medical students and staff when in-person sessions are not practical (Wang, 2022).

The motivational aspect of VR-based learning is another factor to consider. Game-based learning programmes can motivate students by setting new challenges for their progress through interactive incentives (Shackelford et al., 2019). Shackelford et al. (2019) note that, rather than being motivated by the specific opportunity to learn using VR, learners might be attracted to the novelty of the technology and the rewards that are associated with ongoing interaction with it (p. 196). While the entertainment and educational values of VR might appear to be competing against each other, opportunities are being explored for the positive effects of education through e-learning using gamification (Lo & Hew, 2018; Park & Kim, 2021). The decision of some academic institutions to approach certain learning experiences through VR-based learning via gamification has major implications for the institutions' libraries, which become the central hub for VR access and use among the faculty and students (Kouame et al., 2021).

2.2 Challenges of VR access and use in libraries

The reasons for the implementation of VR in libraries, and specifically public libraries, relate primarily to the goal of offering users access to popular technology. According to Massis

(2015), VR is a tool for teaching library users about information literacy while encouraging and supporting engagement with new technology. With this approach, Massis (2015) argues that VR in libraries uses a hybrid of entertaining content, the goal of which is primarily educational. However, subsequent studies by other authors conclude that educational opportunities with VR are often not the main target for library users; instead, users engage with VR in an exploratory manner (Cook et al., 2019; Greene & Groenendyk, 2021).

Cook et al. (2019) discuss 3D and VR in academic, public, and school libraries in the USA in the context of identifying the challenges that affect the adoption of the technologies. Among those are limited budgets, an inadequate understanding of how VR can be used to complement the academic curriculum, and a lack of adequate access to resources in smaller libraries. The participants of the study by Cook et al. (2019) recommended that libraries consider implementing VR that uses smart phone systems instead of headsets in order to cut costs; however, the cost of VR headsets has been reduced since the publication of Cook et al.'s research, which might help to address some of the budgetary concerns (The Economist, 2020). The participants of that study also recommended that academic and school librarians can work with faculty to harness the value of VR for academic purposes (Cook et al., 2019, p. 41), and various institutions can collaborate to deliver equitable services (Cook et al., 2019, pp. 41-42).

The studies by both Cook et al. (2019) and Greene & Groenendyk (2021) mention a lack of strategies for the promotion of specific educational VR content in academic libraries in the USA and Canada. Conversely, Hubert et al., (2021) and Weyant et al. (2021) focus on the logistical aspects of education-focused VR services in academic libraries in the USA. Similarly, Suen et al. (2020) studied two libraries in Hong Kong that introduced VR services for educational purposes, rather than for open-ended exploration. The challenges of the two Hong Kong universities in expanding their VR services in order to reach more users are the limited physical space allotted to them, an inadequate budget, and inadequate technical skills of the staff.

Hubert et al., (2021) and Weyant et al. (2021) cite similar factors that they recommend considering throughout the decision-making process of VR implementation in a library. To Suen et al.'s (2020) list, Hubert et al. (2021) and Weyant et al. (2021) add considerations pertaining to hardware and software that should be readily available for the students and faculty and would support the needs of the curriculum, as well as the provision of the necessary technical knowledge and appropriate staffing to address the needs of the faculty and students. Such considerations might also be applicable to the decisions of public libraries when planning for the introduction of VR programmes and services.

2.3 VR for entertainment, education, or both

Since VR can be used for both educational and entertainment purposes, the two applications can be seen as drastically different or complementary, depending on the strategy of the implementing library. To explore the two potential uses in relation to a particular library, it is important to study the needs and demands of the users who access the technology in specific contexts. As with the conclusions of the study by Greene & Groenendyk (2021), the findings of a study by Frost et al. (2020) of the ways in which VR can be used to benefit the academic experience of university students in Utah, USA, indicated that the majority of users are interested in VR primarily for extracurricular purposes. Both Cook et al. (2019) and Frost et al. (2020) suggest that library staff can collaborate with faculty to help students engage with VR to enhance their academic experience and learn about how to create VR content.

Sample (2020) discusses a study that focused specifically on the ways in which augmented reality (AR) and VR can assist users via a focused learning programme. The results of a study by Sample (2020) of a virtual tour of an academic library in Oklahoma, USA, the goal of which was to help reduce students' library anxiety, showed that students felt more comfortable visiting the library following the virtual tour. Sample (2020) concludes that AR and VR technologies have the potential to offer a valuable learning experience for users. A similar study by Valenti et al. (2020) of VR-based orientation for new library and information science

students at a university in Kansas, USA, concluded that this method was engaging for students and helped to assuage their feelings of anxiety about their new environment.

Although strict learning-focused uses of VR may not be directly applicable to public libraries, they might have implications for the types of learning-focused content that can be developed and offered as part of public libraries' educational programmes and services to their user communities (Bertot et al., 2016; Hartnett et al., 2020). For example, Johnson (2019) discusses the ways in which she, as a school teacher, uses VR as a support tool for her lessons in the classroom, drawing connections between traditional forms of learning and VR experiences that strive to help students engage with the topics about which they learn.

In general, VR can be used as a complementary technology for such diverse purposes as health science education (Lessick & Kraft, 2017); complementary therapy for psychiatric disorders (Cieślik et al., 2020); engineering workplace health and safety; and task-focused learning (Wang et al., 2018). A study by Pope (2018), from the USA, highlighted similar learning opportunities at academic libraries; in addition, the author mentions that VR can also be used for team-building exercises, an application that relates to a form of social learning. However, Pope (2018) notes that some of the participants from academic libraries did not consider VR important for enhancing educational experiences. The question of users' perception of VR for gaming versus education might have a significant influence on library managers' decisions about whether and in what ways VR is useful within the library.

Despite the numerous opportunities for learning-focused VR experiences, given that public libraries serve a community of users with diverse interests, the aim of the libraries in implementing VR might be to merely allow users to engage with the technology without specific agenda. Whilst an education-focused target would fit the mandate of an academic or school library, public libraries might likely take a more leisurely approach toward VR that, nonetheless, supports their overall digital strategy. However, depending on the demands of the users, some

public libraries might choose to market education-focused lessons for specific user groups in the community. For example, a library might introduce a VR-based lesson on manual job skills for employment seekers with or without a component of gamification.

2.4 Users' perceptions of and approaches to VR

In order to gauge user engagement and review possible strategic plans of libraries that respond to the demands of their users, it is important to consider the perceptions of library users of available VR services. A study by Dahya et al. (2021) at the Washington State Libraries in the USA, found that users within that community felt that VR platforms do not feature enough visible diversity to reflect the user community. To counteract this issue, Dahya et al. (2021) recommend that libraries acquire appropriate content and possibly offer education to their users on VR content creation to encourage them to design new applications based on their personal interests. Ellern & Cruz (2021) examine the concept of the identity of libraries as active participants in VR content creation, as opposed to their more traditional role of service deliverers. The study by Ellern & Cruz (2021) concludes that as libraries respond to the ever-changing technological needs of their users, libraries' role in society might also need to evolve accordingly.

Although the libraries Dahya et al. (2021) researched seek to offer VR to the diverse users in the communities they serve, the lack of adequate perceived representation of diversity in VR could be a deterrent for some library users. Other libraries take a different approach. In their personal essay, Hall (2020) discusses a VR programme that they used as a learning tool for veterans and seniors in California, USA through a library outreach programme, which encouraged the users to share personal memories from their past travels after immersing themselves in a virtual travel experience. Unlike the participants in the research by Dahya et al. (2021), Hall's (2020) storytelling-based approach targets and delivers a specialised program to a distinct group of users, carefully selecting applications that help to evoke memories among

them. The article by Hall offers a different framework for delivering learning-based VR to appeal to the users' interests.

It is also important to consider the impact that the COVID-19 pandemic has had on public libraries and the experiences of the users who access them. Libraries in both NZ and abroad had to suspend their in-person programmes and limit the availability of other in-library services in order to limit contact between people (Bray, 2020; Tammaro, 2020). This was a new challenge for public libraries and the response was to offer the regular programmes online. In the case of VR, however, this solution is not feasible, since it requires users to have access to VR headsets at home. As such, the researcher of this project was interested to learn whether and how the public libraries in NZ adapted their VR programming in response to the COVID-19 restrictions.

Of course, the pandemic-related restrictions also affected people's ability to travel internationally, which created new opportunities for VR-based experiences. Sarkady et al. (2021) discuss the trend of VR travel being used as a substitute for actual conventional travel at times of international border restrictions or when users do not feel comfortable travelling. The perception of the experience might be unique for those for whom, for various reasons, actual travel might be prohibitive (Sarkady et al., 2021). However, the authors note that VR travel does not offer an immersive sensory experience that is robust enough to become a real substitute for travel.

The practical examples discussed in the existing literature and outlined above provide valuable context for the understanding of challenges and opportunities that libraries might experience when implementing VR. Generally, public libraries must critically consider the demands and interests of their users and strive to match both the access and use of VR to meet those demands and interests. The scenario presented by Dahya et al. (2021) could apply within any community but would be particularly applicable to communities with special demographics

that might feel that they do not relate to certain VR content. This is a challenge that libraries as inclusive community spaces might strive to address (Hartnett et al., 2020).

It is important to consider, however, that the challenge to meet the needs of numerous demographic groups might prove to be too broad. Hall (2020), on the other hand, presents a case in which they recognised a niche group and specifically designed an outreach programme to bring VR into the community and present carefully selected content for the user group. Both scenarios might also apply to the challenges and opportunities presented to the libraries in NZ in their goal of reaching their diverse user base while also striving to address the unique needs of the different user groups through access to digital technologies (Hartnett et al., 2020).

2.5 Knowledge gaps and research prospects

The majority of the existing literature on VR focuses on academic libraries in the USA. However, this literature highlights several overarching issues that also affect public libraries. Common themes among the libraries in the literature discussed above include VR implementation for educational purposes versus for entertainment; the cost of VR services in libraries; content that is of interest to library users; library space design; and essential technical skills of library staff. Among the previously insufficient data about VR implementation in NZ's public libraries were answers to questions about the reasons why the libraries have introduced VR; the target demographics of users for accessing VR services and for what purposes; what lessons have been learned about the users' experiences with the technology; and what plans the libraries have for the future of VR services and programmes. The literature discussed above provides insights into these aspects of VR services in libraries overseas and highlights the knowledge gap about NZ's public libraries, which provided the impetus for this research.

3. Research design

The literature review highlights the trends with VR access and use in libraries outside of NZ. Although the context in NZ's public libraries is similar, in some ways, to that of other

countries, the researcher sought to obtain a more detailed understanding of VR programmes in NZ. The researcher conducted a preliminary environmental scan in February 2022 by searching the websites and social media pages of the public library systems for references to VR. The results of this preliminary scan showed that, as of late February 2022, 15 public library systems in NZ offered VR.

The researcher chose to implement a qualitative research approach in the form of semi-structured interviews with the managers of the VR programmes at the libraries that offer VR. Please see Appendix 1 for the list of standard questions that were prepared prior to the start of the interview process. This research method was selected in order to allow the participants to share the unique stories behind the development of VR programmes within their libraries. Such stories include phenomenological accounts and personal experiences of the participants as those who either made the decision to implement VR within their libraries, or those who inherited the role from previous colleagues.

This methodology allows participants who are most closely familiar with this work to describe the programmes within their libraries in their own words and offer personal insights, rather than answer questions within strict parameters, as in the form of surveys (DiCicco-Bloom & Crabtree, 2006; Ormrod & Leedy, 2020; Qu & Dumay, 2011). Semi-formal interviews that lead with open-ended questions and allow the researcher to ask additional questions for guidance and clarification offer participants an opportunity for critical reflection and allow the researcher to ask for further detail when required (DiCicco-Bloom & Crabtree, 2006; Ormrod & Leedy, 2020). Although there are some similarities among the methods that libraries employ to offer VR programming to their users, there are also many factors that are unique to the individual libraries, and the researcher wished to understand these phenomena in greater detail. Finally, since the potential sample size of this research was to be up to 15 participants, it was deemed reasonable to plan to conduct interviews with each individual participant to closely explore their accounts (DiCicco-Bloom & Crabtree, 2006).

The participants were selected based on both purposive and convenience sampling. To meet the objectives of this research, the researcher needed to interview the staff who manage the VR programming in the participating libraries. These individuals were selected purposively, as they were the staff from each participating library who were deemed most knowledgeable about the VR programmes and best able to answer the standard questions (Ormrod & Leedy, 2020). Upon identifying the libraries that offer VR in NZ, the prospective participants were contacted via an email message that explained the objectives of this research and provided them with an invitation to participate. The email message also included information and consent forms. Please see Appendices 3 to 6 for these forms and Appendix 2 for the template of the recruitment email. The researcher relied on convenience sampling in the final selection of the participating libraries and their staff who would become the research participants, as some of the 16 individuals who received the recruitment email did not respond to the researcher's invitation (Ormrod & Leedy, 2020). The final sample consisted of nine interview participants.

Each interview was scheduled for a specific date and time between March 15 and April 19, 2022 and lasted approximately 30 minutes. Apart from one interview that was held via a phone call, all the interviews took place via Zoom meetings between each individual participant and researcher. All the interviews were recorded. The researcher chose to de-identify in this report all personal data and data related to the participating organisations in order to guarantee confidentiality for all the participants, as some of the information shared during the interview process may be deemed sensitive by the participants and their organisations.

4. Data analysis

At the conclusion of each interview, the recording of the interview was transcribed. The data was then analysed using thematic analysis. This method of data analysis was selected in order to effectively identify and examine the themes that emerged from each interview, and to gain an understanding of the commonalities and differences among the approaches of the participating libraries toward VR programming. Since the researcher sought to obtain an

overview of the ways in which VR programming is offered in NZ's public libraries, rather than study specific phenomena in greater detail, it was deemed logical to analyse the data using common themes that emerged from the interviews that have direct relevance to the research questions (Nowell et al., 2017; Ormrod & Leedy, 2020).

The researcher used the software NVivo 12 to assign inductive codes to the transcript of each interview, based on the details that emerged during the interviews. The researcher then organised these codes into themes (Nowell et al., 2017; Ormrod & Leedy, 2020). The following are the themes the researcher identified after reviewing the coded data: digital inclusion enables VR programming in libraries; COVID-19 has posed a serious challenge to public libraries' programming; future considerations focus on inclusive VR access and educational content. The emerging themes are aligned with the research objectives and questions and reflect the sub-topics that were discussed during the interviews.

5. Data presentation

Please refer to Appendix 7 for a table that presents some of the data discussed in this chapter. To maintain confidentiality, the participants will be referred to as Librarian 1 through 9, and the participating libraries as Library 1 through 9. All the participating libraries adopted VR technology between 2016 and 2020, with two of the libraries having introduced VR very soon prior to the start of the COVID-19 pandemic, in early 2020.

5.1 Motives for adoption and a look at the current use of VR

In response to **RQ 1** – **What are the rationales and motives behind the introduction and implementation of VR in NZ's public libraries where VR is currently used?** – all the participants expressed the goal of digital inclusion as the impetus for the adoption of VR. The motive was to make the technology available and promote digital literacy for the community of users. According to Librarian 7:

It was introduced with the intent of offering an upper form of digital experience. We're

incredibly focused on accessibility and removing as many barriers to using and

participating in digital stuff as possible. Many people can't afford VR sets or might be

intrigued by the technology but have no other way to interact with it. So, we invest in that

on behalf of our community so they will have those opportunities. It links to a wider

kaupapa around extending the thinking around why libraries have collections in the first

place. If you think about a community as able to afford a much larger, richer collection –

let's say books, initially – by pulling all their money together through their rates, they can

then collectively afford the resources, like books. If you extend your thinking, it can

apply to all manner of things, like VR, 3D printers for their community, PlayStation 5... All

those kinds of things that individual families might not be able to afford on their

own.

Although the overarching goal of digital inclusion, as discussed in the literature by Bertot et al.

(2016) and Hartnett et al. (2020), was expressed among all the participants, only two of the

libraries followed a library-specific digital strategy for the implementation of VR. The other

libraries adhered to the digital strategy of their respective councils. At the time of the interviews,

two of the libraries were also working toward creating their own digital strategy.

All the libraries used a variety of marketing methods to promote VR to their users,

including word of mouth; community outreach; website and social media posts; newspaper

advertisements; library newsletter; and advertisements displayed within the library. Five of the

participants said that VR had previously been used at local events to promote the library, and

that the technology worked effectively as a stand-alone attraction to bring people into the library.

5.1.1 Health and safety; hardware and software; space considerations; and staff training

During the initial stages of VR implementation, all the participating libraries made decisions pertaining to the software and hardware acquisitions, staff education, and health and safety provisions, in line with the discussion in literature by Hubert et al. (2021) and Weyant et al. (2021). Apart from Librarian 7, above, none of the other participants mentioned their budgets as a significant factor in the decision.

Six libraries used the wireless Oculus series headsets. They chose them specifically because the wireless stand-alone headsets allow for easy transport to community locations outside the library; these headsets connect to the Wi-Fi network of the locations in which they are used. However, the wireless nature of the headset presented a challenge. According to Librarian 1, the staff learned that unless the Oculus system is cast to a screen, the staff often were not able to easily assist the users with navigating the experience. Similarly, Library 3 made it mandatory for users to screencast their VR session in order to ensure that they were not searching for inappropriate content. Four of the libraries offer HTC VIVE, which connects via a PC, with the headsets casting onto a computer screen. Three of the libraries use PlayStation VR, which connects to a television screen via a PlayStation console using wires and allows for screen-casting. The screen-casting requires additional space setup considerations due to the required equipment.

Literature by Suen et al. (2020) discusses the challenge of inadequate space for VR in a library. Similarly, all the participants emphasised the importance of ensuring that the space they choose for VR must be unobstructed and large enough to allow users to move safely. The libraries had seating available for older users, as well as for anyone who may choose to sit down during an exploratory experience, rather than a game that requires physical movement. All the libraries ensured that the locations in which the VR system were used were sufficiently

spacious, allowing the users to move around and freely swing their arms in a safe environment while donning a headset. In libraries without a dedicated VR room, several participants mentioned that the staff isolated the play area, sometimes using bollards and ropes, to prevent others from walking through the space while the VR is in use.

Two of the participants found that when the VR system was taken to other spaces in the community, there was often a lack of adequate room for VR, or the Wi-Fi connection was sometimes unstable, which prevented the libraries from offering users uninterrupted programming. However, even within the libraries themselves, there were often challenges with Wi-Fi. Librarian 3 said that the users sometimes experienced bad connections with screen-casting. In addition, Librarian 3 added that since the libraries used the Wi-Fi of their respective city councils, there were sometimes concerns regarding firewalls and proxy issues. At times when the demand by users for VR was high, Librarian 3 found that the battery power of the library's Oculus headset was inadequate; this issue was addressed with the purchase of additional battery packs that can be attached to the headset.

Seven of the participants said that staff training was not a significant concern. Several of the participants explained that they encouraged their staff to play with the headsets on their lunch breaks or during times allotted for professional development. Two of the libraries allowed their staff to take the headsets home to practise using them. However, others experienced setbacks. Librarian 4 said that staff training was challenging because some staff members did not feel confident learning about a new technology. Librarian 6 said that the difficulty was in undergoing training without consistent follow-up. The staff were simply not using the technology frequently enough to remember how it operates. Librarian 8 said that the most challenging part of staff training was to teach the staff how to pack, unpack, and set up the equipment to ensure that it is handled correctly.

Participants considered the types of game and experience apps that library users accessed on VR. Library 7 decided to only purchase apps that are appropriate for the library's general audience. Other libraries chose to offer their users a wider selection. Although Library 3 did not impose an age restriction on access to its VR programmes, Librarian 3 said that by casting all VR activity to a screen, staff can monitor what users access and guide younger users toward age-appropriate apps.

A few of the participating libraries expressed a concern, reported by some of their users, about feeling motion sickness or losing their balance while using VR, particularly with movement in 3D. Librarian 8 said,

> We've had a plan that we put through the council and consulted with our health and safety advisor, particularly with regards to epilepsy and making sure that we're very careful around who's using it. We always talk to each person beforehand. We have considered having a form but chose not to have it because we wanted to make [VR] as accessible as possible.

All the libraries said that they ensured that a staff member always supervised the use of VR. Most of the libraries, including Library 8, limited VR use to approximately 15 minutes per user for their health and safety. The researcher was not able to find any academic information regarding safe time limits for VR usage. For some, such as Library 9, the time limit was in place to allow all users a fair opportunity to play.

5.1.2 Prioritised users

Most of the libraries said that they offered programmes to users of all ages. However, seven of the participants found that VR was mostly popular among the teens in their libraries. Two of the participating libraries offered separate programmes specifically for groups of senior users, either within the library or through community outreach. Librarian 8 explained that when seniors from a rest home would come into the library to try VR, staff knew to be vigilant in

assisting the users with the technology and observing them to ensure their safety: "Obviously, we have to be very careful with their health. We've always had a diversional therapist or a nurse to supervise it, but to give them that experience even for a minute has been really worthwhile." Several of the libraries took VR to schools in the community, particularly in remote areas, to introduce the technology to students who otherwise might not ever come into the library and who might not be aware of the various programmes that were available.

For programmes within the libraries, teens had the freedom to select from the range of VR experiences and games that the libraries had purchased, whereas the experience for seniors tended to be focused on something specific, based on the users' interests. It is important to note that although some of the libraries had not originally planned to market the technology to specific demographics, all the participants reported that the younger demographic was simply drawn to VR and tended to choose gaming activities such as Beat Saber, Job Simulator, or Tilt Brush. For seniors, the libraries recommended experiences such as the Anne Frank House Tour, Google Earth, and Ocean Rift, which are less active than the various games and focus on educational tourism, which was particularly timely when, as discussed in the literature by Sarkady et al. (2021), air travel was restricted due to COVID-19.

While older adults might have received an introduction to VR alongside their regular visit to the library to borrow books or participate in a craft group, the participating libraries recognised that VR can be a valuable strategy to draw teens into the library space and use it to introduce them to the various other library services. According to Librarian 2,

> That was a big point for me because we you know teens' usage is a big struggle for us. Something like [VR] was a great way to draw them into the library and then once they're kind of familiar with using the library then next you start going, "Hey, you know we've got these other programs that are going on. Do you want to take part in it next?"

Conversely, Librarian 5, who worked primarily with teens in her role, spoke about VR as a valuable programme in itself, rather than a gateway to other programmes. Librarian 5 said that it is important to learn about the teens' patterns with the access and use of the library, and to work to meet their needs. She said that she sometimes receives and reviews recommendations from teens for new VR games that they would like to try.

While some of the libraries expressed an agenda to use VR as an introduction to other programmes and services, others, including Library 5, simply promoted VR because of its merits as an interesting technology offered by the library. Librarian 8 expressed that ultimately, VR for teens in Library 8's youth space offered teens variety within the library and helped to promote it as a safe space for the teens. Three participants also emphasised the benefit of VR for users who are neurodiverse or have physical disabilities. Parallel to the literature by Sari et al. (2020), Boyd et al. (2018), and Soccini et al. (2020) concerning VR for therapeutic purposes, a few of the participants have worked with users with autism or dementia, as well as those who use wheelchairs, to assist them with accessing travel experiences in VR. Such experiences help stimulate users' mental and emotional processing (Boyd et al., 2018; Soccini et al., 2020).

There was a lack of consistency among the participating libraries with concern to the minimum age of VR users. Three of the libraries did not allow anyone below the age of 12 to use VR; two of the libraries had set their age limit to 13 years and above. Although Library 1 did not have a set age restriction, Librarian 1 stated that the general guideline for the use of VR in the library was eight years of age and above. The remaining three libraries did not have age restrictions in place. Librarian 3 explained that after reviewing the warnings on the Oculus website and consumer forums regarding age restrictions for the use of the device, he had come to understand that the concern was about the content for Oculus that might not be appropriate for children below a certain age group. The participants that did follow the age restriction guidelines said that they understood the organisational warnings to be related to the

development of children's eyesight and issues with the weight of the headset on children's

necks.

VR-related health and safety concerns, particularly pertaining to eye strain and postural

imbalances, only recently began to be explored in academic literature, such as in the studies by

Hirzle et al. (2022) and Tychsen & Foeller (2020). At this time, however, there is no widely

published academic data to support claims regarding age restrictions with VR. The Oculus

Safety Center website (Meta Quest, n.d.) lists an age restriction of 13 years of age and higher

due to the nature of the content available on Oculus. The PlayStation VR website (PlayStation

VR, 2022) states that the technology is meant for users aged 12 and above. The HTC VIVE

website (VIVE New Zealand, n.d.) does not list information regarding age restrictions.

5.2 Discrepancies between the planned and current application and usage of VR

At the centre of **RQ 2** – **What discrepancies exist between the planned and current

application and usage of VR in public libraries, and how will the current experience affect

plans for future application?** – is the impact of COVID-19 on all library programming,

including VR.

COVID-19 changed the ways in which various in-person programmes are offered at the

libraries, and seven of the nine participating libraries chose to put their VR programming on hold

due to the close contact nature of the activity, particularly when assisting users with the fitting of

VR headsets and the challenge of disinfecting headsets between users. Prior to COVID-19,

several of the participating libraries offered VR via community outreach by visiting schools or

rest homes (see chart in Appendix 7). One of the libraries had only started to offer VR shortly

before the 2020 COVID-19 lockdown in NZ but planned to bring the programme into the wider

community. Similarly, all the libraries used to offer after-school and/or school holiday

programmes, either through drop-in sessions or by inviting users to register for a session at a

set time. Four of the libraries used to offer daytime VR programmes to their users, available for

access during the libraries' opening hours. Two of the libraries featured VR as part of their makerspace studio, rather than as a stand-alone attraction. Three of the libraries had a bus that was used to deliver services, including VR, to remote communities.

Pre-COVID-19, all the libraries would typically bring their VR to special events, such as festivals, outside the library to showcase the technology outside the library. In addition, as was mentioned briefly in the previous session, community groups sometimes collaborated with the library using VR. According to Librarian 4, "I've done some work with a local lady who was doing a study on people with dementia and using VR with them and they actually create a VR simulator for them to use." Such initiatives are similar to the work of Boyd et al. (2018), Marylyn et al. (2021), Sari et al. (2020), and Soccini et al. (2020) with therapy and rehabilitation using VR. The literature by Hall (2020) discusses the work done with veterans with VR as a narrative for past travel experiences. Librarian 4 described a similar project with migrants in the community. "We also had a group of migrant women come in. We've done things with them with Google Earth, so they can go back and check out their hometowns and they show it on the big screen to show people where they came from."

Librarian 8 used VR prior to COVID-19 in conjunction with in-library displays to celebrate special holidays. For Holi and Diwali festivals, the library users had a chance to experience the festivals in India via a brief immersive virtual visit. During Sea Week, the users were offered an underwater VR experience. Linking the VR experience to such events allowed Library 8 to engage its users in a learning experience that not only introduced them to holidays, festivals, and environments about which they may not have known before but also taught the users about a technology to which they may not have been previously exposed. All these programmes had to be put on hold due to COVID-19 restrictions.

The cleaning of VR equipment had become of particular importance to the libraries due to COVID-19. Six of the nine participants said that at the start of the pandemic, their libraries

attempted to continue to offer VR programmes with physical distancing measures and careful

sanitation of the equipment between each use. However, this proved to be a challenge.

Librarian 9 found that the use of disinfectant wipes caused the material surrounding the VR

headset to disintegrate. This was initially resolved with the use of disposable liners that act as a

barrier between the headset and the user's face. That solution, however, was costly for the

library and a decision was made to halt the use of VR while a more sustainable solution was

sought.

Although COVID-19 restrictions had put a stop to the VR programming in most libraries,

and most participants said that, post-COVID-19, they hoped to return to their regular

programming, two of the participating libraries found ways to operate their VR programming with

some restrictions in place. In lieu of the regular drop-in programmes, Libraries 5 and 6 created a

system that invited groups of users to book a private room within the library for VR, and

Librarian 2 said that he was planning to introduce a booking system soon. According to

Librarian 5,

> It's bookable for members of the public for a group and we class a group as a bubble.
>
> We don't require them to wear a mask, but the staff member who's with them does. We
>
> originally had these eye masks that we used to have them put on and then you put the
>
> headset over it, but we found that they kept falling over their eyes and it was not
>
> practical. Now we just sanitise the headset and controls after each [session].

Nonetheless, Librarian 5 also expressed a concern about the decrease in the number of

bookings due to COVID-19. Librarian 6 explained that the booking system was trialled for a brief

period during the school holidays and included both VR and other activities, such as escape

room sessions. It was decided, however, that the VR and escape room sessions necessitated

close contact between the staff and users, which the organisation deemed unsafe.

Last year, Library 1 started to offer its users the option of borrowing a VR headset to take home for two weeks. The VR headsets are part of the library's collection of various other science, technology, engineering, and mathematics (STEM)-based kits, which are meant to foster digital inclusion within the community. According to Librarian 1,

> It's part of a bigger project to make us become a library of things rather than just a library of books. In December I added one of our (VR) headsets into the collection and haven't seen it since, basically. It's been out and last time I checked it had holds until December or January [late 2022 or early 2023].

The headsets are sanitised upon return and prior to being issued to the next user. Librarian 1 said that she was working on adding another VR kit to the lending collection in order to address the users' demand.

5.3 Challenges, prospects, and opportunities for future uses of VR in public libraries

In response to **RQ 3** – **What are the challenges, prospects and opportunities for future uses of VR in public libraries in NZ?** – seven of the participants said that there have been setbacks with the growth of the VR programmes. While several libraries trialled other strategies of VR delivery to their users during the pandemic, others waited to be able to offer VR to their users in a safer environment following an official easing of COVID-19 restrictions in NZ.

5.3.1 VR as a promotional tool

Apart from COVID-19 restrictions, one of the issues that presents both a challenge and an opportunity is the access and use of VR as an attraction. Although none of the participating libraries kept statistics on how frequently users returned to the library specifically for VR programmes and the types of experiences they tended to choose, the participants shared that most of their users did not tend to return to the library for that purpose. According to Librarian 4,

> We do have a few frequent [users] who like to enjoy it. There is a guy who is doing one of the design programmes. He's getting quite good with the software and is starting to be

able to design stuff, but the vast majority are a one-hit-wonder. They come in, they try it.

Sometimes the kids tend to come back, but not over and over and over again.

 Despite this, all the participants said that VR continued to attract new users to the library

and had become an effective promotional tool. Three of the participating libraries that were the

early adopters of VR expressed the opinion that there is a wide potential to explore the

educational aspect of VR and had plans to teach users how to design games and experiences

using the technology. This response is akin to the suggestions made in the literature by Dahya

et al. (2021) to introduce content creation to library users who have experienced VR. Dahya et

al. (2021) explain that this next step would allow users to generate content to reflect their

personal interests and perceptions.

5.3.2 Entertainment and learning opportunities

Gaming versus education is another issue that offers both a challenge and an

opportunity for new developments. Cook et al. (2019) and Greene & Groenendyk (2021)

conclude in their literature that most users explore VR without specific learning-focused agenda.

Most of the participants explained that they worked to provide a balanced blend of

entertainment-focused and educational VR experiences. While older adults largely tended to

use VR specifically for armchair-style expeditions, younger users often received their first

introduction to VR via games. The research by Pope (2015) found that some users do not

believe that VR is an effective tool for learning. However, seven of the participants of this

research said that they strove to promote the educational aspect of the technology. Librarian 1

explained that there is a definitive focus on education when VR is taken to schools in the

community:

We have conversations with the teachers and ask about what they cover over the term.

We had one school that was learning about the pyramids, so we used a VR headset and

the app Wander to go over the pyramids and actually see them. We had one where they

were doing underwater and the ocean [using] an app called Ocean Rift that allows you to experience different sea creatures.

However, Library 1's after-school and school holiday programmes were a more relaxed experience, the aim of which was to merely introduce users to the technology without a strict curriculum-based agenda. Following such introductions, Librarian 1 was planning for the next steps with VR, which would allow the users to learn about design: "I think now that they've done quite a bit of the programmes, our next step will be to change it up a little bit, maybe do some virtual reality design."

Similar to the discussion in the literature by Shackelford et al. (2019), Librarian 3 expressed the opinion that to a certain extent, many experiences on VR constitute education through gamification; whether playing a game or exploring an app that teaches the user about human anatomy, the user receives an introduction to a new technology:

Although it is gamification, it is learning how to use the navigation. A new thing that came out a year or two ago was hand tracking. Before it was all [about using] controls and now you can navigate by pinching. There are a couple of games that are games but they're for learning how to navigate the system, so that was the great thing for (users), that they pick up the ball and put it on fire but they're learning navigation to get around. So, that's the kind of stuff we try and push because we want to show people that it's fun but also that we can do this and then their mind goes to all the movies that they've seen in sci-fi, where they're taking this file and drawing. All that is essentially possible at the VR.

Such opinions pertaining to learning through gamification are in line with the findings of the literature by Lo & Hew (2018), Park & Kim (2021), and Shackelford et al. (2019). Similarly, Librarian 5 and 6 both mentioned the collaborative value of games such as Keep Talking and Nobody Explodes, the premise of which is for a team of players to use a manual to learn how to

disarm bombs and give instructions to one player who implements them in the virtual environment.

Other librarians said that they think that gaming is merely an introduction to the educational opportunities with VR. Librarian 8 said that she worked with the local schools to explain to the teachers the merits of VR. "Many of them thought, at first, that it's just for gaming," she said, explaining that she is not opposed to gaming because it, too, offers opportunities for education. "I strongly advocate for gaming because I know there is a lot of negativity. I have talked to the media class at the local college and we talk about the story aspect of gaming and the narrative aspect. It can be quite a valuable experience as well, if you highlight it."

The technology itself might entice some users, but there are others who might critique it as just another gaming system. Librarian 8 emphasised the importance of educating everyone about the greater purpose of the technology.

> It's taking the time to explain that this is the library and we are giving them the
> opportunity to experience new things. It's also important to highlight with adults that not
> everyone would have the chance to walk down the streets of Paris or visit a Diwali
> festival. It's remarkable. With the Anne Frank one, you're coming out of an exhibition
> and seen where her family lived. It's quite powerful.

Library 9, which was one of the first to introduce VR in 2017, was trialling a partnership with BLAKE NZ-VR (2022), an organisation that works with schools to offer VR-based programmes that educate students about nature conservation and sustainability. Like the other libraries, Library 9 was planning to move beyond the initial introduction of VR as entertainment toward specific educational programmes. According to Librarian 9,

> Now we're getting more experience in terms of what software and platforms we can use.
> I think we're moving toward more structured educational VR, but we're still at the

entertainment side and even our programmes are just dipping their toes in. It's just having the time to design that kind of programming.

The work with VR and other technologies in libraries has influenced Librarian 9 to pursue additional work with the Pasifika communities to address the existing disparities between the Pākehā and the Māori and Pasifika communities in STEM careers (Díaz Andrade et al., 2021; Middleton et al., 2019). Along with a friend, Librarian 9 started a privately funded trust for STEM-focused education for isolated Pasifika communities in the region of Library 9 to strive to create a more inclusive environment by working intensively with the communities of users for whom access to the library and its resources presents a challenge due to prohibitive geographical distances and various socioeconomic and cultural factors.

Librarian 9 explained that it is important for libraries to learn about the needs of the Māori and Pasifika communities and to teach the children in those communities about the prospects of careers in STEM:

> Just having access and creating a space where it's safe for whole families to play with technology, normalise the use of it, and make it not scary has a massive benefit. I always see a huge sense of pride in the kids when they teach their parents how to use technology. That confidence with tech and knowing that it's not a space that they can't be a part of is always a massive driver for me personally. That extends out to the whole community, but definitely those communities that don't see technology as a career path. It's really massive to make sure that they have access to [STEM education] and that they feel confident and have a good learning space for that.

5.3.3 Digital inclusion and community collaboration

Digital inclusion continues to be an important motivator for libraries, and it influenced the participants' ideas for future implementation of VR. In an effort to be more inclusive of the different users, Librarian 3 shared an idea to create library makerspace tutorials in a virtual

space, which would benefit users who might feel some initial anxiety about using the equipment. Similarly to the discussion in articles by Sample (2020) and Valenti et al. (2020), such demonstrations would help to enhance the users' confidence through learning how to use the available tools. In addition, as discussed by Ellern & Cruz (2021), VR content creation by the libraries themselves would position the libraries as active players in directing the focus of VR within the libraries.

To further the efforts of digital inclusion, as per Bertot et al. (2016) and Hartnett et al. (2020), three of the participating libraries mentioned that they had a vehicle for outreach visits to remote communities and included VR services. However, Librarian 3 said that it was challenging to provide staffing for the library's mobile unit. Librarian 9 expressed the hope that Library 9's partnership with BLAKE NZ-VR will help to generate funding from schools toward outreach for rest homes and correctional facilities, to allow the library to provide education to multiple vulnerable groups within the community.

In addition, several participants expressed opportunities for collaboration with other cultural organisations. Librarian 2 spoke about an idea to collaborate with local museums and art galleries to use VR to create three-dimensional models of physical objects that are on display in order to expand the access and use opportunities for both the museums and galleries and the VR technology itself. Similarly, Library 4 had an ongoing active collaborative partnership with the local museum when planning exhibitions, including those that feature VR. Although Cook et al. (2019), Frost et al. (2020), and Johnson (2019) discuss the value of collaboration specifically between academic libraries and schools to harness the value of VR for educational purposes, in a similar manner, libraries and museums can work together.

6. Discussion

The data of this research indicate that logistical concerns about the health and safety aspects of VR, the hardware and software selections, and space considerations are crucial

during the planning and initial implementation stages. Likewise, it is possible that the differences in the experiences of the libraries can also be attributed to their unique logistical factors, including constraints or opportunities that are influenced by the budget, library space, and staffing (Suen et al., 2020). However, those considerations are also important beyond the initial introduction, particularly in response to changes in the wider community.

COVID-19 restrictions led to numerous changes to the VR programming in NZ's public libraries, with a primary focus on physical distancing and sanitation of equipment. With consistent review of the pandemic-focused health and safety restrictions, libraries continued to re-evaluate their responses and made changes, with the majority choosing to postpone all VR programming. While a few of the libraries devised new methods of VR delivery to their users in accordance with appropriate health and safety measures – including the lending of VR headsets to users and the opportunity to book rooms for small groups – the remaining libraries planned to return to their past methods of offering public VR programming in person when possible. Libraries as public spaces have a duty to respond to the needs of their communities of users amid emerging and ongoing challenges (Hartnett et al., 2020). In unprecedented situations, the evaluation and implementation of responsible solutions can be particularly demanding; the responses of libraries that chose unique solutions to the delivery of programmes and services during a pandemic can sometimes help to generate ideas and solutions among their counterparts.

All the participating libraries offer a variety of games and exploratory experiences to their users, and although the majority do not prioritise specific user groups, making the technology available to everyone, they do have programmes designed specifically for teens and seniors. It is also possible to argue that one of the – perhaps unintended – motives of the introduction of VR in libraries was to attract more teens into the library space. The libraries would typically reach teens and seniors through in-house programmes and through digitally inclusive outreach by travelling to schools and rest homes, especially in remote areas where people might not

otherwise have access to library services and programmes (Hartnett et al., 2020). To continue
to effectively address the needs of diverse user groups, ongoing re-evaluation of the available
programmes and initiatives is important.

The focus on programmes for teens and seniors allows the participating libraries to
choose a variety of VR experiences for those groups. The libraries offer those users an
opportunity to learn about the technology, as well as its capabilities; some libraries have
leveraged VR to promote other programmes and services. However, some of the participating
libraries are starting to consider the next steps to direct their work with the technology toward
programmes that are focused on education, specifically in working with schools, while others
are taking a more conservative approach by planning to return to their previous methods of pre-
COVID-19 VR programming.

Initiatives that identify a specific challenge and highlight a discrepancy between the
needs of a community group and the programmes offered by the library are of particular
importance to consider. The literature by Hartnett et al. (2020) discusses the perception of
public libraries as inclusive communities that are working actively to address the challenges of
the digital divide. In this research, Librarian 9 spoke about bringing STEM-focused educational
programming to Pasifika groups, while other libraries reached schools and remote communities
via mobile vehicles. New and emerging technologies that are introduced by libraries to meet the
goal of digital inclusion must re-evaluate, on an ongoing basis, their methods of reaching
diverse groups.

Dahya et al. (2021) explored library users' perceptions of VR. Their findings indicate that
some users do not feel that they can identify with the technology and its experiences; the
literature recommends teaching the users content creation for VR in order to address their
interests. Without data from the participating libraries regarding returning users and their
perceptions of the technology and related experiences, it is challenging to understand the next

steps that the libraries could take to harness VR beyond the purposes of mere introduction to the technology. As the research by Dahya et al. (2021) has shown, such data can help to understand the users' motivations, perceptions, and additional interests concerning VR.

Public libraries that choose to promote VR for educational purposes can expect to invest a significant amount of time in the design of educational programming for the intended user groups. Cook et al. (2019) and Greene & Groenendyk (2021) conclude in their literature that to date, the primary focus for users of VR in libraries is the open-ended exploration of the technology, rather than education. Similarly, as was described by Librarian 4, many users try the technology once or twice without returning. Without a specific goal and a strategy to keep users returning to the library for VR, users might come in to try the technology during a single visit and without comprehending its continuity of purpose, never attempt to use it again. This is another challenge for libraries to consider.

To further expand on the data and ideas presented by Dahya et al. (2021), by introducing users who are familiar with the entertainment aspect of VR programming to the educational element of VR content creation, libraries could offer those users a platform to explore their interests. By studying the experiences of those users and the content they might create, libraries could learn about the needs and interests of the users. Such conclusions could contribute to and help to harness the development of new VR programming. Such opportunities would also translate to the collaborative work with museums that was discussed by Librarians 2 and 4 in the previous chapter.

7. Limitations

Although the nine participating libraries comprised an effective representative sample for the purposes of this research, given the numerous nuances of the ways in which the libraries offer VR programming, the researcher recognises that this project would have benefitted further from data from the other libraries in NZ that offer VR but which did not participate in this

research. It would be interesting to learn about their experiences and plans. However, such

work is beyond the scope of this research project.

With reference to Dahya et al. (2021), the research data could be further enriched by

surveys conducted with the users of VR in libraries regarding their perceptions of the technology

and the available content, as well as their ideas. Furthermore, by observing the libraries' VR

users, the researcher could gain a better understanding of their behaviours with the technology.

Such insights would help to inform the libraries' processes of the re-evaluation of their VR

programmes and plans for future implementation.

8. Conclusion

The method of semi-structured interviews was effective for the context and scope of this

research in allowing the researcher to understand the subtleties of the experiences of the

participants and their respective libraries with VR programming amid the challenges presented

by COVID-19. Thematic analysis allowed the researcher to categorise the individual narratives

of the participants in order to gain insight into the commonalities and disparities among the past

experiences of the libraries and the lessons that were learnt, as well as designs for future

equitable VR programme delivery.

All the libraries operate through the common goal of digital inclusion and there are

similarities in their approaches to logistical decisions. However, despite the similarities, there

are discrepancies in the participants' understanding of age restrictions and other health and

safety factors, which can be explained by the fact that VR has only become available to the

general consume in the recent years. Without clear guidelines from the VR hardware

manufacturers and in the absence of data about the health and safety aspects of VR, such

variations warrant further research.

Where the discrepancies among the participants are more consequential is in the

libraries' responses to COVID-19 restrictions and subsequent plans. Although several libraries

altered the methods of their VR programme delivery by lending headsets or offering room bookings for private groups, the remainder were waiting for the lifting of restrictions to return to their previous methods of in-person VR programming. Several libraries spoke about their plans to continue working toward the growth of educational VR content, including the development of new content by the libraries themselves. Others emphasised their commitment to community outreach. However, all the libraries expressed an ongoing dedication to continuing to make access to VR available to their diverse user groups and within the wider community.

9. Implications of findings and opportunities for future research

The impact of COVID-19 on public library programming has been a central theme to this research. It would be of benefit to pursue further research into the ways in which the public libraries will continue to adapt their VR programming after the easing of the pandemic restrictions. It would also be interesting to study the impact that current VR programming in public libraries will have on the future development and implementation of other emerging digital technologies and the relevant strategies within the libraries.

The work of Librarian 9 to deliver STEM-based programming, including VR, to Pasifika communities invites further research, reminiscent of Dahya et al. (2021), into the perceptions and expectations of Māori and Pasifika library users of VR and other STEM-related programmes in public libraries. Furthermore, with a focus on digital inclusion, it would be prudent to examine the steps the libraries plan to take to address any discrepancies that might exist between the current programme delivery and the data that might result from such research.

Given the discrepancy in the responses of participants concerning the age restrictions of users, and a current lack of published data regarding age restrictions and safe time limits for users of VR, it would be beneficial to revisit this topic in the future in order to learn about new data and its possible implications for the libraries' future VR programming. Several of the participants expressed an interest in expanding the focus of VR for learning. This offers an

opportunity to research the types of educational programming content that will be produced in the future, both within the public libraries and in collaboration with other partners in the community.

Additionally, it would be of interest to evaluate in further detail the strategy of utilising popular technologies such as VR to promote other programmes and services within public libraries. Finally, it would also be of interest to survey all the remaining public libraries in NZ about their attitudes toward the idea of VR and whether they would ever consider introducing or are planning to start offering VR programmes, and the reasons for such decisions. The perceptions and opinions of the libraries that do not currently offer VR could provide valuable insight for a more robust understanding of this topic.

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    Testing of a Virtual Reality Anatomy Lab. *Journal of Electronic Resources in Medical
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Appendices

Appendix 1: Interview questions

The following are the standard interview questions that were asked:

- When was VR first introduced in your library?

- For what purposes was VR introduced?

- What logistical factors (e.g., staff training; software and hardware decisions; space planning, etc.) did you consider throughout the planning process to add VR to the programmes and services to your library?

- What user groups have been prioritised to date?

- What strategies have you used to reach the user groups?

- How does VR fit into your overarching digital strategy?

- What kinds of VR programmes and / or services does the library offer?

- Where do you offer VR programmes and / or services (e.g., within the library or through community outreach)?

- How do your users currently access VR for educational purposes, gaming, or both?

- What methods have you used for tracking the progress of the programmes and / or services to date? Would you be open to sharing that data for the purposes of this research?

- How frequently do the users return to the library specifically for VR experiences? What types of experiences do they choose? Is the access and use behaviour consistent, or does it vary with each visit?

- What have been the greatest benefits and challenges that you have experienced since first implementing VR in your library?

- What ideas do you have for future equitable VR access within your library and the greater community?

Appendix 2: Template of the recruitment email to participants

Tēnā koe _____,

I am a Masters student in the Information Studies programme at Te Herenga Waka – Victoria University of Wellington. For my INFO 580 Masters research project, I am studying the motivations and prospects of the implementation of virtual reality programmes and/or services in Aotearoa New Zealand's public libraries (Victoria University of Wellington Human Ethics Committee Application No. 30101).

Following a preliminary environmental scan, I have identified your library as an organisation that offers virtual reality programmes and/or services to its users. As such, I would like to invite you to participate in a 30-minute interview via a telephone call or a Zoom meeting. Your participation in this research would assist me in forming a better understanding of the access and use of virtual reality services and/or programmes in the public libraries of Aotearoa, as well as the lessons you have learnt throughout the planning and implementation process, and how these lessons may inform future strategic plans within your organisation.

I have attached the following documents for you to review:

- Participant information sheet
- Participant consent form

I have also attached the following documents for your library's senior manager to review:

- Information sheet for organisations
- Consent form for organisations

If you would like to take part in this research, please ask your library's senior manager to review the above documents and sign the consent form for organisations. Please also sign your participant consent form and return both these signed forms to me via email by 11th March to grodecyakt@myvuw.ac.nz. I will then contact you to arrange a suitable time for the interview.

Should you have any additional questions about this research, please do not hesitate to ask me.

Ngā mihi nui,

Katia Grodecki

Appendix 3: Information Sheet for Organisations

Motivations and prospects for the adoption and implementation of virtual reality in Aotearoa New Zealand's public libraries

INFORMATION SHEET FOR ORGANISATIONS

Tēnā koe,

Thank you for your interest in this project. Please read this information before deciding whether or not your organisation will take part. If you decide to participate, thank you. If you decide not to take part, thank you for considering my request.

Ko wai ahau / Who am I?

My name is Yaktrina (Katia) Grodecki and I am a Masters student in Information Studies at Te Herenga Waka—Victoria University of Wellington. This research project is work towards my INFO 580 Research Project course.

He aha te whāinga mō tēnei rangahau / What is the aim of the project?

This project aims to answer questions about the reasons behind the implementation of virtual reality programmes and/or services in New Zealand's public libraries, as well as the ways in which virtual reality is currently and will continue to be implemented in the libraries.

Your organisation's participation will support this research by contributing to a knowledge base that will help individual public libraries in New Zealand to make informed decisions about plans for virtual reality for their users. This research has been approved by the Te Herenga Waka—Victoria University of Wellington Human Ethics Committee (RME No. 30101).

Ka pēhea tō āwhina mai / How can you help?

Participation in this research is entirely voluntary for your organisation and your employee(s). If you agree to take part, I will interview your employee(s). I will ask them questions about the background of your organisation's decision to implement virtual reality; how it is being accessed and used; and what strategic changes the organisation has made or plans to make to the virtual reality programmes and/or services. The interview will take approximately 30 minutes. The employee(s) will either complete the interviews during work time or after work time, with your permission. The interviews will take place via a telephone call or a Zoom meeting. Each individual participant will be asked to provide consent before their involvement in the research. I will audio or video record the interview with the permission of the

participant(s) and write it up later. The identity of your organisation and the interviewee(s) will not be revealed in the research outputs and any identifying details will be kept confidential.

Ka ahatia ngā kōrero ka tukuna mai / What will happen to the information the participants give?

Your organisation and interviewee(s) will not be named in the final report.

Only my supervisor and I will read the notes or transcript of the interview. The interview transcripts, summaries, and any recordings will be kept securely and destroyed on 30th April, 2027.

He aha ngā hua o te rangahau / What will the project produce?

The information from my research will be used in my Masters research project and potentially in academic publications and conferences. I will also provide your organisation with a report summarising the results of the research.

Ki te whakaae mai koe, he aha ō mōtika hei kaitautoko i tēnei rangahau / If you accept this invitation, what are the rights of your organisation?

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

•   ask any questions about the study at any time;
•   withdraw your organisation's participation from the study before 29th April, 2022;
•   be able to read a report of this research.

Mehemea ngā pātai, he raruraru rānei, me whakapā ki a wai / 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 me or my supervisor:

Student:	Supervisor:
Name: Yaktrina (Katia) Grodecki	Name: Anne Goulding
University email address: grodecyakt@myvuw.ac.nz	Role: Professor of Information Services Management
	School: Information Management
	Phone: anne.goulding@vuw.ac.nz

He kōrero whakamārama mō HEC / Human Ethics Committee information

If you have any concerns about the ethical conduct of the research you may contact the Te Herenga Waka—Victoria University of Wellington HEC Convenor by emailing hec@vuw.ac.nz.

Appendix 4: Consent to Participate (Organisations)

Motivations and prospects for the adoption and implementation of virtual reality in Aotearoa New Zealand's public libraries

CONSENT TO PARTICIPATE (ORGANISATION)

This consent form will be held for 5 years.

Researcher:

Yaktrina (Katia) Grodecki, Masters of Information Studies student, Te Herenga Waka—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 that my organisation will take part.

I understand that:

- I may withdraw this organisation from this study at any point before 29th April, 2022, and the information provided by members of the organisation will be returned to them/or destroyed.

- Any information the participant provides about the organisation will be included in a final report with pseudonyms used to replace your organisation's name and the name of the participant, but the transcripts and recordings will be kept confidential to the researcher and the supervisor.

- The identities of the participants will not remain confidential to the researcher; however, any confidential information and details of the participant will be de-identified following the interview.

- The results will be used for a Masters report and potentially academic publications and/or presented to conferences.

- I consent to information which is given by the participants being attributed to the organisation in any reports on this research and have the authority to agree to this on behalf of the organisation.

                                                                              Yes o   No o

- I would like to receive a copy of the final report and have added my email address below.

                                                                              Yes o   No o

Signature of participant: _____

Name of participant: _____   Date: _____

Contact details: _____

Appendix 5: Information Sheet for Interview Participants

Motivations and prospects for the adoption and implementation of virtual reality in Aotearoa New Zealand's public libraries

INFORMATION SHEET FOR INTERVIEW PARTICIPANTS

Tēnā koe,

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.

Ko wai ahau / Who am I?

My name is Yaktrina (Katia) Grodecki and I am a Masters student in Information Studies at Te Herenga Waka—Victoria University of Wellington. This project is work towards my INFO 580 Research Project course.

He aha te whāinga mō tēnei rangahau / What is the aim of the project?

This project aims to answer questions about the reasons behind the implementation of virtual reality programmes and/or services in New Zealand's public libraries, as well as the ways in which virtual reality is currently and will continue to be implemented in the libraries.

Your participation will support this research by providing information pertaining to the implementation of virtual reality in your public library. This information will allow the researcher to form a better understanding of the access and use of virtual reality in New Zealand's public libraries. The findings of this research will contribute to a knowledge base that will help individual public libraries in New Zealand to make informed decisions about plans for virtual reality for their users. This research has been approved by the Te Herenga Waka—Victoria University of Wellington Human Ethics Committee (RME No. 30101).

Ka pēhea tō āwhina mai / How can you help?

You have been invited to participate because a preliminary environmental scan has shown that your organisation offers virtual reality programmes and/or services. Participation in this research is entirely voluntary. If you agree to take part, I will interview you via a telephone call or a Zoom meeting. I will ask you questions about the background of your organisation's decision to implement virtual reality; how it is being accessed and used; and what strategic changes the organisation has made or plans to make to the virtual reality programmes and/or services. The interview will take approximately 30 minutes. I will audio (if via a telephone call) or video (if via Zoom) 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 before 29th April, 2022. If you withdraw, the information you provided will be destroyed or returned to you.

Ka ahatia ngā kōrero ka tukuna mai / What will happen to the information you give?

You and your organisation will not be named in the final report.

Only my supervisor and I will read the notes or transcript of the interview. The interview transcripts, summaries and any recordings will be kept securely and destroyed on 30th April, 2027.

He aha ngā hua o te rangahau / What will the project produce?

The information from my research will be used in my Masters report and potentially academic publications and conferences.

Ki te whakaae mai koe, he aha ō mōtika hei kaitautoko i tēnei rangahau / 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 before 29th April, 2022;
•   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 the transcript of your interview;
•   be able to read any reports of this research by emailing the researcher to request a copy.

Mehemea ngā pātai, he raruraru rānei, me whakapā ki a wai / 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 me or my supervisor:

Student:

Name: Katia Grodecki

University email address:
grodecyakt@myvuw.ac.nz

Supervisor:

Name: Anne Goulding

Role: Professor of Information Services Management

School: Information Management

Phone: anne.goulding@vuw.ac.nz

He kōrero whakamārama mō HEC / Human Ethics Committee information

If you have any concerns about the ethical conduct of the research you may contact the Te Herenga Waka—Victoria University of Wellington HEC Convenor by emailing hec@vuw.ac.nz.

Appendix 6: Consent to Interview

VICTORIA UNIVERSITY OF
WELLINGTON
TE HERENGA WAKA

Motivations and prospects for the adoption and implementation of virtual reality in Aotearoa New Zealand's public libraries

CONSENT TO INTERVIEW

This consent form will be held for 5 years.

Researcher:

Yaktrina (Katia) Grodecki, Masters of Information Studies student, Te Herenga Waka—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 a video or audio recorded interview.

I understand that:

- I, in accordance with the advice of my organisation, may withdraw from this study at any point before 29th April, 2022, and any information that I have provided will be returned to me or destroyed.

- The identifiable information I have provided will be destroyed on or before 2nd May, 2022.

- Any information I provide will be kept confidential to the researcher and the supervisor.

- The findings may be used for a Masters report and potentially academic publications and/or presented to conferences.

- The interview notes and recordings will be kept confidential to the researcher and the supervisor.

- Organisational consent has been provided and the organisation will not be named in any of the reports.

- My name will not be used in reports and utmost care will be taken not to disclose any information that would identify me.

- I would like a copy of the transcript of my interview: Yes o   No o

- I would like to receive a copy of the recording of my interview   Yes o   No o

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

Signature of participant: _____

Name of participant: _____ Date: _____

Contact details: _____

Appendix 7: Data summary – Usage of VR in the libraries as of March-April 2022

	Date of Interview	Date introduced	Number of Headsets	Type(s) of Headset(s)	Methods of VR programme delivery						Age limit
					Lending	In-library daytime programmes	After-school and school holidays	Special events	Community outreach in schools and rest homes	Room booking	
Library 1	15/03/2022	about 2019	5	3 Oculus Quest 2 used within the library; 2 Oculus Quest for lending	Yes	No	Yes	Yes	Yes	No	8+
Library 2	21/03/2022	2020	1	Oculus Quest 2	No	Yes	Yes	Planned	Planned	Planned	13+
Library 3	21/03/2022	2020	1	Oculus Quest	No	Yes	Yes	Yes	Yes	No	None
Library 4	21/03/2022	about 2019	2	HTC VIVE; Oculus Quest	No	No	Yes	Yes	No	No	None
Library 5	21/03/2022	about 2017	1	PlayStation 4 VR	No	No	Yes	Yes	Yes	Yes	12+
Library 6	22/03/2022	2016-2017	2	Playstation VR; HTC VIVE	No	No	Yes	Yes	No	Trialled briefly	None
Library 7	24/03/2022	2019-2020	6	4 Oculus Quest; 1 Quest 2; 1 Quest Go	No	No	Yes	Yes	Yes	No	13+
Library 8	4/4/2022	2018-2019	2 + classroom set	Oculus Quest; HTC Vive; cardboard VR classroom set	No	Yes	Yes	Yes	Yes	No	12+
Library 9	19/04/2022	2017-2018	4 + classroom set	3 HTC VIVE; 1 PlayStation VR; Blake NZ-VR classroom set	No	Yes	Yes	Yes	Yes	No	12+

Students' name: Yaktrina (Katia) Grodecki

Total number of words: 11,576 (pp. 4-38)