ENZ International Education Product Innovation Fund Project Final Report

Project Title	Virtual Reality (VR) Childbirth Simulation
Project Entity	Virtual Medical Coaching
Project Sponsor	James Hayes
Project Manager(s)	James Hayes
ENZ Kaitautoko	Kenneth Holt
Date of Report	30/05/2023

Executive Summary

Please describe the project succinctly (2-4 paragraphs). You may like to include:

- *The focus of the project*
- *What took place*
- *Any high-level results or outcomes*
- *1-2 key learnings.*

The focus of the project was to expand on the pilot version of our VR childbirth simulation software. The software was initially a minimal commercial product that we were requested to do by Ara, who had been using our radiography simulation software for two years. The goal with the help of PIF funding was to improve the childbirth software by adding features (such as new birthing positions) to make it a more complete product, and ensure it was scalable and fit for purpose in teaching organisations both in New Zealand and globally to allow VMC to take it into market as a saleable product and begin generating revenue.

We broke down the existing pilot with our user advisory board's advice and added new features. The result was a straightforward physiological VR birth that sadly we didn't get time to include complications such as shoulder dystocia or cord prolapse into – this would have greatly added to the project. As it is it is a very good undergraduate first year VR training tool. We plan to add more complications later, as we have built the simulation with that possibility in mind.

Developing the childbirth simulation software was a challenging project that required us to learn a lot about the complexities of midwifery, such as the movement of placentas and the different stages of labour. We are proud of our achievement, and we hope to continue innovating and providing tech-driven solutions for healthcare problems.

Deliverables/Milestones

Please detail completion of all funding deliverables in the table below.

Phase 1 Deliverables/Milestones	Success Measures	Completion Status	Commentary

Engagement with ENZ around pilot objectives and deliverables and opportunities for ENZ to add value	Engagement meetings held.	Completed	
Development of Hypotheses and Success Measures.	Hypotheses and Success Measures finalised.	Completed	
Define support needs.	Support needs defined.	Completed	
Establishment of operational pilot plan and budget, reporting mechanisms, and partnership cadence	Operational plan and budget provided to ENZ. Monthly reporting process established, and regular partnership meetings scheduled.	Completed	
Formalising external partnerships	n/a	n/a	The proposal was not a joint proposal.
Conducting and analysing early-stage learner research and completion of market research / competitive analysis	n/a	n/a	This was not part of Phase 1 for this project.

Phase 2 Deliverables/Milestones	Success Measures	Completion Status	Commentary
Functional VR but incomplete features and no smooth art finesse	*Does it load and can a user progress from start to finish.*	Fully Completed	

Phase 3 Deliverables/Milestones	Success Measures	Completion Status	Commentary
Functional VR product review and iteration based on live performance data and customer feedback.	Subjective positive feedback from current users.	Completed	
Pilot evaluation and reporting.	Completion of this report.	Completed	

Close pilot (if applicable)	Can the solution be sold as a standalone learning tool?	Completed	Demonstrated with commercial sales.

Deviations

No major deviations

Original intent (as per proposal)	Deviation	Rationale	Decision-making process
Functional stand-alone physiological birth VR simulation.	*Fewer features developed.*	*Ran out of time and budget due to the unforeseen complexity of development associated with the subject matter.*	*n/a*

Results / Outcomes

Please provide any further details about results and outcomes from this project you would like to include, such as data on learning outcomes, commercial outcomes or other. This can be attached as an appendix or supporting material if easier.

Subjective feedback from AUT, Ara, and Bangor University has been excellent and they can see how they will incorporate this simulation training into their teaching. AUT and Ara in particular are interested in using this for research which will hopefully be good for us and spread the word about this simulation.

Our visit to the Australian Midwifery conference in Canberra was productive and we received positive feedback from Griffith University and the University of South Australia. We are awaiting their final decisions, but we are optimistic about the prospects.

Finances

90% of our costs were on software development with the rest split between project management and marketing. The expenses table below is not editable!

INCOME	BUDGET	ACTUAL	VARIANCE (%)	COMMENTARY
ENZ Funding	$300,000.00	**$300,000.00**		
TOTAL INCOME	**$300,000.00**	**$300,000.00**		
EXPENSES				
Development Work	$211,100.08			
Administration	$34,300.00			
Material Writing / Editing	$19,984.64			
Marketing	$34,615.30			
Eg, Food				
Eg, Administration				
TOTAL EXPENSES	$300,000.02			

Insights and Learnings

Observation/data	*Learning*
1. Virtual Medical Coaching's (VMC's) goal was to create a versatile virtual reality training tool for midwives that can be used in different countries. They faced the challenge of adapting to the diverse practices and standards of midwifery across the world. To overcome this, they designed a Configuration that allowed them to customize and update various aspects of the virtual reality. This way, they can ensure that the tool is always relevant and realistic for the users. They also wanted to maintain a high level of immersion in the virtual reality, which is crucial for effective learning. They avoided any elements that could break the illusion of reality, such as unrealistic graphics or movements.	**Learner-centred** One of the advantages of VR is that it allows for more flexible configuration than products that are designed for specific markets. VR can adapt to different contexts and needs without requiring major changes or investments.
2. VMC's radiography simulation software has been proven to enhance student performance in clinical settings. A paper published in January this year showed that students who used their software scored higher on 22 out of 24 criteria than students who were trained with other methods. Another study from South America confirmed that four out of five students performed better with their radiography software. These results indicate that their software is not just a gimmick, but a paradigm shift in virtual reality teaching for radiography. However, they need more evidence to support	**Learner-centred / deliberate innovation** Data and evidence are necessary to support claims of improved learner outcomes for innovative learning products.

	this claim, particularly for the childbirth software. They hope that other universities or institutions will conduct similar studies with their childbirth simulation and demonstrate that their software and learning design can improve student outcomes in terms of speed, accuracy, and quality. The software has the potential to revolutionize midwifery training, improving outcomes for learners, but more research is needed to validate its effectiveness across different contexts.	
3.	A balanced approach to research is needed. Soft evidence, such as personal testimonies, opinions, and impressions, can provide valuable insights into the benefits of an intervention, but it is not enough to convince others of its effectiveness. Hard evidence, such as statistical tests, measurements, and experiments, can provide more objective and reliable support for an intervention, but it is not always available or feasible. Therefore, it is important to combine both types of evidence and present them in a credible and transparent way. VMC have videos of student midwives who shared their experiences with their simulation. These are some examples of soft evidence that show the potential impact of their intervention. However, they also acknowledge the limitations of soft evidence and the need for more rigorous evaluation.	**Learner-centred / deliberate innovation** Combining soft and hard evidence is effective for demonstrating the effectiveness and impact of a virtual reality simulation or other innovative learning products.
4.	One of the challenges of introducing new technology to potential clients is convincing them to try it out for themselves. For example, virtual reality is a technology that cannot be fully appreciated by watching videos or reading descriptions. It requires a first-hand experience to understand its benefits and possibilities. However, getting clients to participate in a virtual reality demonstration can be difficult, especially if they are sceptical or unfamiliar with the technology. This creates a dilemma: clients want to see evidence of the value of virtual reality before they invest in it, but they can only see that value by experiencing it first-hand. VMC need a high-impact, scalable marketing and sales solution that is both cost effective, and allows them to demonstrate the benefits of their product first-hand.	**Deliberate-innovation** Edtechs that focus primarily on product development may lack a scalable marketing and sales solution to enable growth and are not accessing the right expertise early enough in the product development cycle to solve this problem.
5.	Commercialising and distributing a product: Imagine developing a virtual reality software product instead of a piano. You need all the keys to sell the piano. Similarly, VMC had to create a product that was good enough for the universities to use it for teaching. They couldn't reduce the features any further and still call it an MVP (minimum viable product). They feel that they should have called it an MCP (minimum commercial product) instead.	**System-level** External support can be highly valuable for edtechs helping them to bridge the gap in development between prototype and building it out to a minimum commercial product, which is a critical and challenging stage.
6.	To make sure their product met the needs of their customers, they invited students to test it and give them feedback. They came to VMC's office on Fridays and were offered pizza and coke. Their feedback was priceless. User feedback is	**Learner-centred** User-centred iterative design can be applied effectively in edtech

	essential to produce an MCP that people will buy and use. Developing a virtual reality software product required VMC to balance the features and the feedback to create an MCP that satisfied their customers and goals.	product development, with the right incentives (which don't need to be costly).
7.	One of the challenges that VMC faced with Ara students was their diversity of preferences and needs. They could have spent another decade refining their product but had to draw a line at some point and evaluate its effectiveness as a learning tool. They did not have the resources of a AAA design company like Weta, with millions of dollars in budget. Their goal was to deliver more than adequate, very comprehensive and high-quality training, and they achieved that. They also had to prioritize the essential features over the nice-to-have ones in their product development process.	**Learner-centred** User-centred design needs to be carefully managed and directed, filtering out the nice-to-haves from the critical adjustments to user experience when building out the MVP/MCP.
8.	Collaborating with Educational Providers: VMC benefits from working with universities and colleges, as they have access to students, professional expertise and teaching skills. In return, they get an early version of VMC's product, which they can use and shape according to their needs. The challenge is to avoid making the product too specific to one region or context. For example, if VMC only worked with Ara, they would have a solution tailored for the South Island of New Zealand. Therefore, they need to test their product in different countries and markets to ensure its global appeal.	**Learner-centred / deliberate innovation** Partnering with the customer can provide invaluable feedback in a way that costs very little during early stages of product development. However, the provider will still need to go through a phase of adapting a product for multiple customers and regions with diverse requirements.
9.	Getting feedback from users before the product is finished: The product has to show the whole experience of a woman who arrives at the birthing suite in advanced labour and ends up breastfeeding her baby. That's the minimum requirement. It must have a woman giving birth. But testing the product with users in iterations allows VMC to launch any segment of it in their development studio. For example, they can launch something from minute 10 to minute 15 and ask for feedback on specific aspects, such as the second stage of labour or the delivery of the placenta. These are very detailed examples that they cannot share with anyone commercially and ask for their opinion. It has to be done in a very controlled environment, partly because it's not safe to distribute their code like that because it can fall into the wrong hands, but more because they want someone to give very focused feedback on a very deep level about one thing.	**Deliberate-innovation** Building a high-trust partnership with early adopters can accelerate testing and iterating to speed up the development process, reduce costs and enhance impact.
10.	Simulation in education and regulatory constraints: providers that VMC work with are constrained by policies in terms of their ability to adopt the VR product – for example, with limitations on the percentage of simulation that learners can count towards qualification completion. This limits the value of the product to the provider and the learner, and also fails to allow for the potential of the VR product with its adaptive	**System-level** Operating and funding models in the tertiary sector can inhibit innovation, by impeding the adoption of new solutions.

ability to accelerate learning for some students. Furthermore, funding models don't enable students to complete their training in a compressed timeframe – something that could be possible with VR, since funding is tied to duration of study and programme "completion", rather than achievement of learning outcomes.	
11. Some universities VMC collaborates with disregard the regulations that restrict the use of simulation in health education. These regulations are imposed by different professional bodies that specify the percentage of simulation allowed in their programs. However, many universities choose to exceed these limits because they believe that simulation is an effective and ethical way to teach their students. They either comply with the regulations in other ways or simply ignore them and use their software extensively.	**Deliberate Innovation** Collaborating with partners who share a similar mindset and have a balanced appetite for risk can accelerate innovation.
12. Setting up Virtual Medical Coaching outside of an academic institution: Ara's simulation technology for radiography was very outdated (over 30 years) and James Hayes (VMC founder) saw VR as a potential solution. Software engineers could create a virtual hospital like a VR game. It was just code. However, academic institutions usually lacked the funds for development and in this case Ara senior management encouraged the establishment of VMC as an independent company completely outside of Ara. Ara could not dedicate the necessary funds to develop such an initiative. Sometimes a company is needed to realize a great idea and VMC was created with a small and agile team. As a result, VMC had more autonomy and flexibility to make changes.	**System-level** Institutional funding and/or strategic constraints may inhibit internal innovation.
13. VMC had to fight for credibility, even with James' 20 years of experience in the industry. Having a reputable institution behind VMC would have helped. For example, Monash in Australia developed something similar and had more recognition based on their research reputation.	**System-level** It can be costly for edtech providers working outside of the regulated sector to overcome credibility challenges, especially when developing products and services for regulated providers.
14. Pros and cons of adaptive learning: VMC have developed a software that implements adaptive learning, which is an educational method that uses computer algorithms and artificial intelligence to deliver customized learning experiences to each student based on their responses and needs. From a university's perspective, this has some advantages and disadvantages. On the one hand, it enables personalized learning for each student, which can increase their engagement and performance. On the other hand, it also means that some students may complete the course faster than expected, which may not be optimal for the universities. Universities want students to stay for three or four years, pay their fees and contribute to their business. Hayes believes that VMC may be offering something that is	**System-level** There is a potential misalignment between tertiary funding models and innovative solutions that accelerate learning or provide a tailored learning journey. This misalignment may inhibit innovation in the sector.

too good for them because they have some students who are young, smart and have few responsibilities. These students could finish some of the courses in maybe 18 months to two years instead of three years using adaptive learning because it identifies their strengths and addresses their weaknesses. The universities like it, but only up to a point. There is no way of rewarding or challenging a student who finishes their anatomy credits six months into a year's paper. They can just sit there and do nothing for the rest of the year as far as the university is concerned. So this is something that everyone wants, but they don't always use it to its full potential. But Hayes thinks a change for that has to come from the top. It has to come from the Ministry of Education or someone who says that degrees are based on competence, not time.	
15. The accreditation system does not recognise the potential of adaptive learning software to tailor education to individual students' needs and abilities. Adaptive learning software can save time and enhance learning outcomes for students in different fields. For example, in radiography, some students may have a strong background in physics, while others may have a strong background in human anatomy. Adaptive learning software can allow them to progress faster through the topics they are familiar with and spend more time on the topics they need help with. However, the accreditation system does not allow this flexibility and instead requires a fixed number of hours for each topic. This means that some students are working harder than necessary in some areas and getting bored in other areas. Having developed this software and the algorithms behind it, it is frustrating that it is not used to its full potential. The current regulations measure time rather than competency, which does not reflect the actual skills and knowledge of the students. For example, a midwifery student may witness 50 normal births in a certain number of hours, but never encounter any complications. On the other hand, a simulation can expose them to five complicated births in a shorter time and prepare them better for real-life scenarios. Therefore, the accreditation system should keep up with the technological advances that enable more effective and efficient simulation-based learning.	**System-level** There is a misalignment between accreditation frameworks that measure achievement (in part) in terms of time spent learning, and innovative solutions that accelerate learning with adaptive technologies, and focus on competencies. This misalignment may inhibit innovation.
16. Being a New Zealand edtech company has some drawbacks and benefits. In Australia, VMC faces the Big Brother syndrome, where they look down on NZ as a smaller nation. But in the UK, they can leverage their New Zealand identity, as many people there have positive associations with NZ. They often tell them stories about their visits and how they enjoyed NZ wine. Then they can segue into talking about VMC's simulation products.	NZ brand/identity can help open doors in certain markets or instances for edtechs, but this is more about enabling relationship building opportunities than reputation for innovation or tech products.
	NZ brand/identity can be perceived negatively in

	certain markets for edtechs, including Australia.
17. VMC gets a lot of support from NZTE, Education New Zealand and other government agencies. They help VMC with funding, networking, and promotion. For instance, ENZ arranged a call with AUT and invited some influential people to see what VMC does. One example of how being a New Zealand company helps VMC is when they were semi-finalists in an innovation of the year award two years ago. The Prime Minister, Jacinda Ardern, came and congratulated them personally. Hayes doubts that would happen in many other countries. Another example is when an MP from Christchurch visited VMC after hearing that they were a successful exporting company. NZTE set up the meeting for them. These are nice stories to share about being in this city. Hayes thinks the smallness of New Zealand really helps. They are not a tiny fish in a gigantic pond, but a medium sized fish in a big pond.	**System-level** Government support for early-stage edtechs can make a significant difference, boosting credibility, opening doors and making valuable introductions onshore and offshore. **System-level** Strong government support is a source of competitive advantage for NZ edtechs.
18. Another advantage of being a New Zealand company is the way workers are treated here. People who come here, especially in the health sector, expect to find a good job and a pleasant lifestyle. That reflects well on VMC as a company with a good reputation. So, it's about the reputation of New Zealand and its companies.	NZ brand and identity can provide a commercial advantage for edtechs who are recruiting globally.
19. As a software company, VMC focuses on developing virtual reality applications for universities. However, they also depend on the hardware that supports them. Sometimes, they encounter potential clients who are sceptical about how their products would work for them. Fortunately, most universities have some access to virtual reality equipment, either in engineering, architecture, or health sciences. They can offer them a trial version of the software and guide them through it remotely. This strategy helped VMC secure their first contract in the US with a group in Austin, Texas. They were impressed by their software and have been loyal customers for three years. Therefore, they see the lack of widespread hardware as a challenge rather than an obstacle. VMC's software is not limited by hardware availability. They can demonstrate its value and functionality to any potential client with existing virtual reality equipment, regardless of their field or location.	**Deliberate Innovation** Digital education products lend themselves to global scalability. Sales (demonstration) and distribution of VR products can be hampered by access to standardized hardware, but this obstacle can be minimised through software design.
20. VMC's Business Model: As a software-as-a-service-company, Virtual Medical Coaching offers a fair pricing model for different institutions. The number of students enrolled in each university varies widely. For instance, AUT has 130 students while Ara has only 30. To account for this variation, they charge a per student fee. This way, the universities pay VMC according to the number of licenses they use and the student fees they collect. This ensures that	SAAS models for edtech products enable growth through flexibility in pricing models.

their pricing is proportional to the size and revenue of each institution. Virtual Medical Coaching's pricing model is fair and scalable because it charges per student and aligns with the size and revenue of each university.	
*Please detail any **additional** observations and/or learnings that have emerged since the kōrero. You may like to address learnings that relate to* ● *Blockers or obstacles* ● *Capabilities/resources* ● *Learner or customer insights*	
Observation/data	*Learning*
Following discussions with academic staff at the aforementioned learning institutions, we have been strongly encouraged to incorporate problems in the simulation so that learners can address these as part of their training.	**Deliberate Innovation** Collaborative testing partnerships with institutional users can accelerate and/or focus product development.
A business analyst would have been a valuable addition to our company during this project. They could have also acted as a product owner for the software development. Their role would have been to identify potential problems at the start of the project, instead of us running out of time at the end. This does not mean that we would have chosen a different solution, but we would have made an informed decision early on.	**System-Level** Early-stage edtechs may not be accessing the commercial expertise required for expansion early enough in their business cycle.
VMC has employed a midwife who is writing a PhD thesis on the childbirth simulation. She had recently interviewed a midwifery student who had completed 25.5 hours of simulation training before her first hospital visit. The student said that the simulation helped her gain confidence and evidence-based skills. She was able to communicate effectively with the lead midwife and offer her assistance in the birthing suite. She did not feel overwhelmed or nervous like some students who have not had enough exposure to the realistic scenarios. The simulation also prepared her for the sights, sounds and sensations of childbirth. She was more comfortable and respectful towards the mothers who were in labour. The simulation hours for other students interviewed varied from 25.5 to 6, but they all made a positive difference for the students and the mothers.	**Learner-centred** VR can improve learning outcomes in the case of professional training that relies on experiential learning, improving comfort through exposure to challenging situations, and developing communication skills that can transfer into a real-world environment.

Impact

Please describe any impact from this project on your organisation or community (1 - 2 paragraphs).

PIF funding from Education New Zealand increased VMC's development hours and significantly improved the childbirth simulation though the addition of new features and updated art (higher

resolution, more realistic environment), and the addition of new ethnicities for the user and the birthing mother – a critical element in the global scalability of the product. We always consider the return on investment of any development time, and the PIF fund helped us create a better product by taking it closer to a comprehensive MVP by boosting our development capability, and accelerating the process. We are grateful for this opportunity as well as the introduction to Auckland University of Technology's Midwifery department that ENZ facilitated. They will hopefully use our software and we are also in talks with Waikato University. They are launching a new course in January 2024 and want to use our software as well. The Dean of Healthcare Sciences talked about the severe shortage of maternity care in the Waikato region, which is affecting the quality and safety of the service. This is why they decided to offer a midwifery degree, starting with 20 students and expanding to 40 the following year.

Next Steps

The project: This project is now being paused as we have a fully working environment which is our MVP that Universities and Colleges can purchase. We do wish to continue to build on what we have to expand the positions the mother births in and add complications as this will make it more robust and attractive as a teaching tool.

Future research: VMC has employed a midwife who is writing a PhD thesis on the childbirth simulation. She had recently interviewed a midwifery student who had completed 25.5 hours of simulation training before her first hospital visit. The student said that the simulation helped her gain confidence and evidence-based skills. She was able to communicate effectively with the lead midwife and offer her assistance in the birthing suite. She did not feel overwhelmed or nervous like some students who have not had enough exposure to the realistic scenarios. The simulation also prepared her for the sights, sounds and sensations of childbirth. She was more comfortable and respectful towards the mothers who were in labour. The simulation hours for other students interviewed varied from 25.5 to 6, but they all made a positive difference for the students and the mothers.

The PhD thesis will be very valuable when it is published although we have to wait for a couple of years instead of a couple of months as we would for a paper. There are also some other lecturers at Ara who are doing some research with it for papers, conference presentations and so on.

Recommendations

What recommendations do you have for ENZ Manapou ki te Ao and/or Government? You may like to consider:

- *The Product Innovation Fund process (application, administration, delivery, reporting)*
- *Wider support for diversifying international education products and services*

PIF Process: The PIF was a great initiative that provided not just some greatly needed funding that enabled us to push the technical stretch of our MVP but also provided us with numerous warm contacts from contacts of the PIF network.

I felt there were too many meetings with other PIF recipients given that we were all so different and the shared roadblocks didn't seem to exist – this is the one thing I would change in the future.

Wider Government support: The games industry contributes $400 million to New Zealand's economy annually. However, it is very costly to start a business in this sector. Once established, we can attract significant foreign investment to New Zealand. The government could support us more, as in any other industry. The PIF funding was crucial for our success. Without it, we would have run out of funds $300,000 earlier. It enabled us to create a high-quality simulation that pushed the boundaries of our field.