Veative End of Project Report

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Limina Education Services

VEATIVE End of Project Report

An Independent Evaluation Report

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Contents

Abbreviations

CBAM	Concerns-Based Adoption Model
MNED	Metro North Education District
VR	Virtual Reality
WCED	Western Cape Education Department

Monitoring and Evaluation Report

The Veative VR Pilot Project's implementation was independently evaluated. Data was collected in the form of interviews with all the stakeholders, including the Western Cape Education Department's officials, teachers and learners at the schools, a Veative representative and IT Masters representative. Documented evidence in the form of project plans, lesson plans and responses to a questionnaire was also included in the data set. The data was analysed using the Concerns Based Adopt Model (CBAM) developed by Hall and Hord in 1987 and repeatedly validated since then.

Using the CBAM, the innovation configuration map is described first. Thereafter findings from an analysis using the Levels of Use and finally the Stages of Concern are discussed.

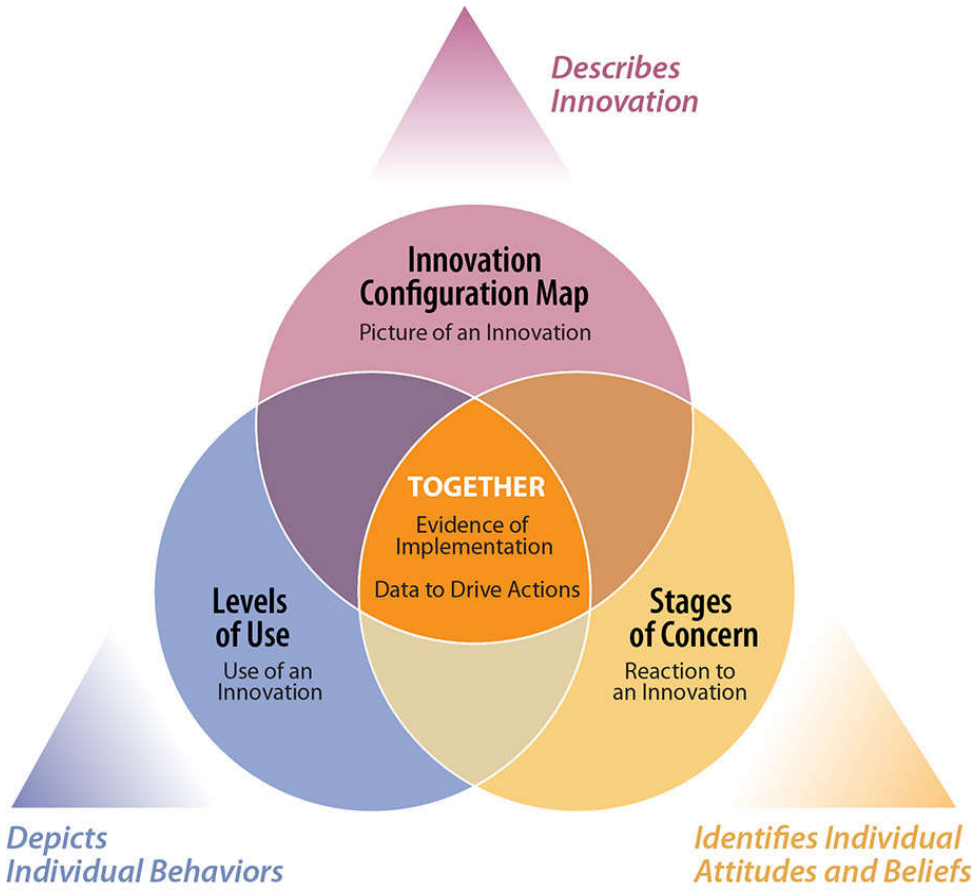

Figure 1 The Concerns-Based Adoption Model (Hall & Hord, 1987)

1) Innovation Configuration Map

The innovation configuration map in the CBAM model describes the various aspects of an innovation and provides a clear picture of what a high-quality implementation could potentially look like. The innovation configuration map also identifies the stakeholders, strategies used for the implementation and the timelines for implementation.

The Western Cape Education Department (WCED), Veative and IT Masters collaborated to provide a Virtual Reality (VR) learning solution in two pilot high schools in the Western Cape. VR technology provides an immersive experience to support learning. It potentially increases learners' motivation and engagement with learning content, and through visualisation and the VR environment there is evidence to suggest that a higher degree of learning is retained.

In terms of functionality, VR technology should ideally include various features. VR technology when used in classrooms, should ideally be used in conjunction with a classroom management tool that would allow the teacher to manage multiple headsets with a single application (app) on a tablet or teacher device. As learners work through the various virtual activities, data from their engagement and usage should be collected and recorded, whether offline or online, and assessments tracked. However, as Ms Anita van Vuuren explained, the project did not initially require the teacher app and this was not included in the project plan. The intent set in the project plan was to only provide learners with an immersive experience while investigating how teachers engaged with different learning strategies for implementation or methodologies of use. Since learners would use the devices in a learning station and learning hub format, the function to record individual progress was not used.

The pilot project set out to test the VR technologies and test potential teaching and learning strategies that could be used to guide implementation thereof in schools and institutions. This report aims to provide feedback relating to three points raised in the project plan:

1. The usability of the solution
2. The scalability of the solution
3. The content and relevance of the solution

Stakeholders

Different stakeholders were involved in the project. The WCED and two schools participated in the pilot project. The WCED identified Parow and Settlers High Schools, both situated in the Metro North Education District (MNED) as potential pilot schools. The eLearning adviser, Mr Esethu Stofile, and Ms Mariette Starke, project facilitator at MNED approached the principals and teachers, and presented the project to them. With the support of the two (2) teachers at each school teachers (totalling four (4) teachers) and school leaders at both schools, the project was initiated in early 2019. Towards the end of 2018 and the start of 2019, then newly appointed Deputy Chief Education Specialist for eLearning Projects for the WCED, Ms Anita van Vuuren, also became involved in the project. The goal for the WCED in piloting the VR technology was to test the relevance of the technology for implementation in classroom and learning spaces.

VEATIVE and IT Masters collaborated to provide a VR learning solution in two pilot high schools in the Western Cape. Veative is a multinational company that provides educational technologies and learning solutions to schools and industries around the world. Veative provided VR headsets and learning content to unlock the power of immersive technologies for learning and develop learners' skills in using these technologies. Veative's goal with the project was to better understand the South African learning space in school classrooms in order to improve their product for greater adoption in schools across the country.

IT Masters, although based in Johannesburg, partnered with Veative. IT Masters participated in the project as the implementation partner and agreed to provide local product support. Their goal was to learn from the experience and develop best practise in terms of VR implementation for future roll-outs of a similar nature.

At the time of the pilot project, a Veative representative, Susanna Ackerman, was also available. She was also based in Johannesburg and flew to Cape Town when needed, but also provided support telephonically and virtually at other times.

These stakeholders participated in the project in various capacities. The CBAM is particularly interested in the adoption of the VR technology by the primary users or those managing their use, in this case the teachers. Hence, while taking full omniscience of the important role of each stakeholder

in this project, the analysis of data specifically emphasises the levels of use and stages of concern as this pertains to adoption of the VR technology by teachers.

Learning Strategies for Implementation

Each school was provided with one VR kit. The VR kit consisted of 8 headsets preloaded with pedagogically relevant content for the Grade 9 and 10 Natural and Physical Science learners at each school. In both schools the average ratio was 1 device : 35 learners.

In the initial project scope, it was decided that teachers would:

1. Explore content, selecting 6 – 8 relevant topics that relate to teaching and learning areas covered in that time in the class.
2. Implement 3 different methods to implement the VR technology:

a. Choose 2 topics from the given list, and design 2 learning stations that would integrate the VR technology into each lesson.

b. Choose 2 topics and using the resource centre or library to create a learning hub where learners can participate during break or after school and use the VR technology to explore these learning areas.

c. Choose 2 topics and devices using their own initiative to decide on a learning task.

2) Levels of Use

Eight levels of use are described in the CBAM. These 8 levels describe behavioural profiles relating to the use of devices or technologies. It ranges from non-use, orientation, preparation and mechanical use, to routine use and refinement, integration and renewal. The **levels of use** are useful to analyse how the VR technology was used in the different settings. In order to analyse this, the timeline for implementation is first discussed. Thereafter the levels of use are analysed.

Timelines

- January 2019: Information session held with SCPs; selection of schools and teachers.

- 6 March 2019: Introduction to the trial / pilot project by Anita van Vuuren followed by consultation with all stakeholders. Templates for lesson plans finalized.
- 14 March 2019: Susanna (Veative) and Natanya (IT Masters) travelled to Cape Town to introduce teachers with VR technology. Unfortunately, they only brought 1 or 2 devices and these devices did not have the correct content loaded. Teachers could therefore not get the full immersive experience and left with many questions and concerns. At this event, teachers requested that the teacher app be loaded on a mobile device (like a laptop or tablet computer) to them to monitor what learners see when using the VR devices. At the time Anita raised some concerns and even though this was not initially included in the project plan, the Veative team agreed to this request. However, this caused considerable challenges, with the Veative submission on the 20 May 2019 noting:
- "*in hindsight this should have been planned for and not added at that stage as it did have unnecessary repercussions*."
- As a result of the Teacher app being loaded, aliases and log-ins had to be created on the system and posed an unanticipated hurdle to users. The log-in screen differed from that demonstrated at the 14th March training. The devices used a Bluetooth connection to pair headsets with remotes. This caused tremendous frustration as different remotes would randomly pair with different headsets.
- 25 March 2019: Anita visits schools to provide teachers with pedagogical and technical support, showing them how to plan for learning stations and learning hubs, and letting them practise using the devices.
- End of March 2019: The education lead for Veative resigned, impacting the implementation of the project.
- 25 April – 14 May: Teachers at both Parow and Settlers High Schools facilitated Learning Hubs and Learning Stations. A detailed timeline of this is included in the two tables below.
- Throughout the project: The WCED MNED district officials, Mr Esethu Stofile and Ms Mariette Starke made multiple unplanned visits to provide ongoing support to teachers especially at Parrow High School, to enable the successful implementation of the project.

- WhatsApp group: A WhatsApp group was created and provided ongoing support to teachers throughout the course of the project. They could ask questions, share ideas or request assistance on the group, or share progress in an informal relatively safe space. Here teachers had direct access to the project team at any given moment.
- June / July 2019: Appointment of independent evaluator
- August 2019: Research & preparation of final project report

Table 1: Parow High School Timetable of VR Usage

Date	Learning Strategy Employed	VR Content Topic selected	Grade	Subject	Class Size
Date	Learning Strategy Employed	VR Content Topic selected	Grade	Subject	Class Size
25 Apr	Learning Hub	Photosynthesis	11	Natural Science/Life Science	32
25 Apr	Learning Hub	Cellular respiration	11	Natural Science/Life Science	32
29 Apr	Learning Hub	Colour Blindness	12	Natural Science/Life Science	32
30 Apr	Learning station	Section of the eudicot root	10	Natural Science/Life Science	32
30 Apr	Customized/Choice (Learning Hub)	Cardiac Cycle	10	Natural Science/Life Science	32
02 May	Learning Hub	The ear	9	Natural Science/Life Science	32
02 May	Customized/Choice (Learning station)	Atoms and symbols	8	Natural Science/Life Science	32
07 May	Customized/Choice (Learning Hub)	Food chain	8	Natural Science/Life Science	32
08 May	Customized/Choice (Learning Station)	Prokaryotic cell	8	Natural Science/Life Science	32
09 May	Learning Station	Blood vessels	9	Natural Science/Life Science	32
13 May	Learning Station	Appendicular skeleton	9	Natural Science/Life Science	32
14 May	Learning Station	Appendicular skeleton	10	Natural Science/Life Science	32

Table 2: Settlers High School Timetable of VR Usage

Date	Learning Strategy Employed	VR Content Topic selected	Grade	Subject	Class Size
26 Apr	Learning Station	Anatomy of the heart	9	Natural Science	32
26 Apr	Learning Station	Anatomy of the heart	9	Natural Science	32
29 Apr	Learning Station	Sound, waves and light	10	Physical Science	31
29 Apr	Learning Station	Sound, waves and light	10	Physical Science	31
29 Apr	Learning Hub	Sound, waves and light	10	Physical Science	31
29 Apr	Learning Hub	Sound, waves and light	10	Physical Science	31
29 Apr	Learning Hub after school	Anatomy of the respiratory system	9	Natural Science	32
29 Apr	Learning Hub after School	Anatomy of the respiratory system	9	Natural Science	32
30 Apr	Customized/Choice	Electricity	10	Physical Science	31
30 Apr	Customized/Choice	Electricity	10	Physical Science	31
13 May	Customized/Choice	Parts of the digestive system	9	Natural Science	32

As can be seen from the Table 1 and 2 above, teachers kept to the initial agreement in the project plan. Teachers at both Parow High School and at Settlers High School presented at least 2 x Learning Hubs, 2 x Learning Stations and 2 x Customized / Own Choices where a combination of Learning Hubs and Learning Stations were used.

Learning Design

When new technologies such as the VR technologies are introduced into learning spaces, it is imperative that learning is designed to effectively integrate the technology to support learning. To this end, teachers agreed to complete planning schedules using a pre-designed lesson planning

template. A lesson planning template was provided for both the Learning Hubs and the Learning Stations. Teachers were required to reflect after each activity on the learning that took place. It was hoped that the planning would be communicated before each event with the stakeholders who would then be able to arrange to visit and observe the lessons in actions.

Two completed lesson plans were submitted for inclusion in this report, both from Grade 9 teachers dated for the 13 May. There is a tendency to assume that teachers did not prepare lesson plans, or to assume that learning design did not occur since there is no printed evidence of this. However, evidence from interviews with learners and teachers indicates that the devices were used as indicated on the Tables above despite lesson plans not being submitted for this. Esethu also noted that in many cases there was some delay between the preparation of lesson plans and when the actual learning hub or learning stations took place. This was often due to the challenges experienced with the devices and pairing devices and remotes and configuring these using the Bluetooth connections. Due to these delays and recurring postponements, the mid-year exam season threatened to prevent the implementation of pilot, but teachers eventually managed this.

Levels of Use

As can be seen from the timeline and learning designs, there were degrees of use of the innovation in classrooms during school, during breaks and even as teachers reported, in after-school hubs. Based on the descriptions of the levels of use in the CBAM model, the teachers interviewed can be positioned at *Level III) Mechanical Use*. They made some changes to and organised their routines to make use of the VR technologies. This included adapting their class schedules to create learning stations. It also included setting up Learning Hubs during break and after school. They had not generally used learning stations in their pedagogical approaches before and including this learning strategy to integrate the VR technology was a positive outcome of the process.

However, even though they had made changes, one cannot say that these changes became routine or that a pattern was established. Although the VR technology was available for some time at the school (and teachers raised concerns for its storage while at the school) no teachers used the devices beyond the original agreed 6 learning events. Should teachers have wanted to make greater use of the devices, the opportunity to do so was available to them but none made use of this. Instead, one of the most frequent observations noted in the interviews with teachers and the

eLearning support team from the WCED was the emphasis on keeping the technology working as smoothly as possible. The use of the teacher app in this sense, coupled with the challenges with the Bluetooth connectivity challenges between devices and remotes, significantly contributed to teachers' inability to move beyond a Mechanical Level of Use on the CBAM.

3) Stages of Concern

The seven Stages of Concern on the CBAM model relate to: 0) Awareness; 1) Informational; 2) Personal; 3) Management; 4) Consequence; 5) Collaboration; and 6) Refocussing. These seven stages of concern are often grouped into three or four groups depending on the research focus. Frequently the stages are grouped 0 –> 2 = Self; 3 = Task; 4 -> 6 = Impact. The Lakeside TLC for example clusters the stages of concern as indicated in Figure 2. This suggests that teachers' concerns can be grouped in

Lakeside's TLC Clusters of Concern	CBAM Stage of Concern	Typical Statement
Planning	0: Unconcerned	"I think I heard something about it, but I'm too busy right now with other priorities to be concerned about it."
	1: Informational	"This seems interesting, and I would like to know more about it."
	2: Personal	"I'm concerned about the changes I'll need to make in my routines."
	3: Management	"I'm concerned about how much time it takes to get ready to teach with this new approach."
Student Learning	4: Consequence	"How will this new approach affect my students?"
Collaboration	5: Collaboration	"I'm looking forward to sharing some ideas about it with other teachers."
	6: Refocusing	"I have some ideas about something that would work even better."

Figure 2 The clustering of the Stages of Concern from Lakeside's TLC retrieved 4 September 2019 from: http://www.classroomscience.org/ngss-and-the-teaching-learning-collaborative-its-about-the-process

terms of concerns related to planning, then student learning and lastly collaboration with colleagues and others.

The data overwhelmingly supports a finding that all teachers participating in this pilot remained at the Planning Cluster of Concern. The evidence indicates that they started at the information stage, moved through the personal and were mostly in the management stage of concern at the time of the data collection.

After the initial meeting, the teachers and school leaders had all successfully moved into *Stage 1) Information*, where they were seeking more information. Information shared with them concerned the safe use of the devices, not using with children who have vertigo for example, or avoiding the use of VR where it may trigger epilepsy in learners. Teachers shared this information with learners who were able to convey these safety instructions with the interviewers. Various suggestions were raised by both learners and teachers with regards to safety and use of the devices:

- Learners did not like the strap at the back of their head and generally found this very unhygienic and uncomfortable. A harness was suggested that should be permanently attached to the device as a fail-safe to protect it from accidently being dropped.
- Learners found it difficult to hear the sound from the small speakers especially in noisy classrooms. They suggested instead that a mini-jack earphone or earplug port be made available to allow users to use their own.
- During the interview, the phrase: '*Learners with impaired vision uses* (sic) *the device on own risk*' from the Veative project plan was probed. Learners participating in the interview at one school all wore spectacles, while 4 of the 6 learners at the other school wore spectacles. They all noted that they felt their spectacles made it more challenging to use the VR goggles and some tried using it without their glasses which of is not ideal.
- Teachers at Parow High were generally concerned about storage of the devices. They felt it should be stored more securely. They noted that there was a general lack of proper storage facilities and that security was a concern.
- Teachers also requested more workshops '*where we could learn how to use the goggle and try it ourselves'*.

Teachers next moved through *Stage 2) Personal*. Different sets of data confirm this finding. Teachers sought information about the technology and potential monitoring processes from Natanya

and Susanna on the 14 March and worked with Anita later in March to plan their learning hubs and station activities. Teachers were generally unfamiliar with the learning stations model with for example one teacher noting: '*Station learning was done which is a good thing but more help would be needed.*' At a personal level of concern another teacher felt though that other teachers would find the many technical challenges overwhelming and that much '*work needs to be done to change mindsets and motivation*' before they would be interested.

The data from interviews, reflections on lessons and the eLearning advisers' comments indicate that teachers reached *Level 3) Management*. Many concerns raised by teachers, subject advisors and other stakeholders refer to concerns related to time and how much time it took to get ready to teach using the VR technology.

- Learners and teachers repeatedly noted their frustration with the time wasted to pair the VR devices / goggles with the correct remotes as discussed previously, often as much as 20 minutes of a 45-minute lesson. Most learners expressed their disappointment that their time on the VR goggles was almost always cut short, with one learner capturing the general feeling:
  '*Just as you finally get into it, and you finally get to enjoy it your time is up and it's someone else's turn!*'
- A few learners also felt that space was a challenge. They couldn't get close to each other or their devices would lose their pairing, so they had to stay far apart. In classrooms already full of other learners this wasn't always possible. One learner solved this challenge by going to work outside in the corridors.
- Teachers and subject advisors corroborated this finding and noted with equal frustration the tremendously time-consuming nature of using the VR technology. One teacher explains:
  '*The interference between the goggles and the remotes is a major problem so even if you increase the quantity the physical space would stay too small.*'
  As many of the interviewees suggested, she suggested that the remote and goggles rather be tethered to remove the need for the Bluetooth connection. If this were not possible, a more secure coupling should be created because as Anita van Vuuren noted, this challenge caused a negative emotional experience for all users which significantly impeded the successful implementation of the project.

- Charging the devices took some time and was another concern. There were not enough multiplugs to charge all the devices at once so teachers at one school took these home. One teacher explains:
  '*I took them home to charge them at home because it took so long to charge at school. It's really not great because you feel like you have a big target on your back but there's just not enough time in the day at school.*' Although they noted that a battery lasted a period, this was not enough for multiple classes to use it directly after each other.

Concluding statements

This report sought to address three issues:

1. The usability of the solution
2. The scalability of the solution
3. The content and relevance of the solution

Regarding the usability of the solution, teachers, learners and the WCED officials from MNED were generally very positive about the potential of the VR technology and specifically the content loaded on the platform. Their greatest frustration and concern related to the use of the devices, the time wasted in trying to get the goggles and remotes to pair, and to keep these paired. They felt that the suggested changes discussed herein could improve the design and overall functionality of the product, and that teachers could then implement it more successfully in their classrooms. Most notably, they repeatedly requested the removal of the Bluetooth connection and that this be replaced with a cable tethering. Other suggestions relate to the provision of a neck harness to provide a failsafe should the device fall off someone's face and a mini-jack port where earphones can be plugged in as the speakers are not usable in a noisy class.

The scalability of the solution using learning hubs and learning station strategies can be achieved through intensified teacher training. Various teachers raised the need for more workshops to learn how to use the devices and the teacher app. The eLearning advisers from MNED also emphasized the importance of teacher training to settle teachers' nerves and show them how to use the devices and learning strategies. They also suggested that subject advisers should be trained '*to make sure they can help with the support*' at scale.

The content, as discussed above, was praised by learners, teachers and advisers from MNED. As can be seen from Table 1 and 2, select elements from the bank of Veative resources could be paired with CAPS-related topics. Unfortunately, individual learner tracking and assessment could not be tested at this stage, but this would be a positive next step to expand the relevance of the solution to a South African setting.

Overall the project has the potential for positively impact education but certain key areas need to be addressed for this potential to be realized. The technology itself and particularly the pairing between goggles and remotes, and the use of the teacher app needs to be addressed. This caused tremendous frustration and needless loss of time, and resulted in negative emotional reactions towards the solution. Secondly, teachers require not only workshops in how to use the devices but ongoing in-time support as that provided by the eLearning advisers from MNED until they develop the confidence to use the devices effectively in learning spaces with learners. Thirdly, pedagogical support and particularly training in the use of transformative learning strategies and pedagogies such as the learning stations and hubs as that provided by Anita van Vuuren, and the subsequent support she provided to teachers as they prepared their learning designs, was a crucial. Teachers need to be explicitly guided as Ms van Vuuren did, to develop such pedagogical tools and strategies. Lastly, it would be ideal if a professional learning network or community was established where teachers could share their experiences and learn together as they navigate the new devices and software. This would potentially have a greater impact on scaling such solutions across a wider geographic area as teacher learning hubs would be formed that could support more teachers in future in a self-perpetuating, sustained manner.

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