



**3D Interactive Visual
Simulations (VR) as an aid to
Learning in Africa**

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VR Survey Analyses

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VR in Africa – for Africa – by Africa

NOTE

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1 Introduction

UNESCO and its agencies have, since 2000, supported a number of initiatives with the Naledi3d Factory that have explored the potential of Virtual Reality (VR) as a learning tool in developing regions of the world, to date in Uganda and Ethiopia. These projects were designed to explore the potential of VR as a learning tool in developing countries.

In order to define a way forward in this programme area, UNESCO commissioned this research project, which evaluates the comparative advantages of applying multimedia and interactive 3D tools to the learning environment.

This project was divided into two areas:

1. An overview of latest research into how the human brain learns; as well as the general practices and approaches to the use of multimedia and interactive 3D tools as learning aids.

The resulting report “*3D Interactive Visual Simulations (VR) as an aid to Learning in Africa - An Evaluation*” found that the human brain is essentially a visual organ and therefore that interactive visual learning has a strong role to play in education. One of its conclusions was “*There is only one ICT application that is able to satisfy ALL the above African learning requirements by creating fully interactive, simulated, virtual 3D environments and that is Virtual Reality.*”

2. An evaluation programme in South Africa and Uganda covering a number of schools and community tele-centres.

This report summarizes the findings of actual surveys undertaken in schools and multi-purpose centres. This practical study and the results of this evaluation programme in South Africa and Uganda would either support or otherwise the theoretical results reported in the first, background report referred to in point 1.

To date, VR initiatives in Africa have resulted in:

- The development of a VR model addressing the learning points around basic hygiene in rural African communities. The main aim of this project was to use interactive visual simulation (VR) as a means of demonstrating basic hygiene to rural communities and to focus primarily on sanitation, water and the prevention of associated diseases (such as malaria, bilharzia, dysentery and cholera). The resulting model was piloted and used at the Nakaseke Telecentre in Uganda. A second goal of this project was to pilot and test the use of VR as a computerised interactive training method in African Telecentres. Nakaseke is approximately 40 miles north of Kampala.
- The training at the Naledi3d Factory in Pretoria of two VR developers from Uganda. Since the completion of the second training session in early 2002, other pilot VR models have been developed, including “DC motors” and “French for Ugandans”, both of which have been used in Kings’ College Budu and St Henry’s Kitovo, both Ugandan schools.
- The creation of a formal VR Committee in Kampala, established to co-ordinate VR initiatives in the country; with representation from two universities (Makerere and Kyambogo), SchoolNet Uganda, the Uganda National Commission for UNESCO, the Department of Education, the National Curriculum Development Centre, as well as a number of local schools.
- A VR workshop, sponsored by IICBA (International Institute for Capacity Building in Africa) and hosted by the Naledi3d Factory of Pretoria, in March 2002, with senior representation from Uganda, Ethiopia and Nigeria and which also resulted in pilot VR models to describe levers, relative velocity and chemical elements.
- A project using VR as an aid to helping young people of all ages in Alexandra (Johannesburg) understand better the job application process, how to keep a job and how to create your own employment space.
- A project to help educators in Ethiopia better understand HIV/AIDS, as well as associated issues, with the aim of helping to empower educators to better teach other, downstream learners.

Perhaps the following words best summarise the importance of education and the reasons for this study:

“Education is both a human right in itself and an indispensable means of realising other human rights. As an empowerment right, education is the primary vehicle by which economically and socially marginalised adults and children can lift themselves out of poverty and obtain the means to participate fully in their communities. Education has a vital role in empowering women, safeguarding children from exploitative and hazardous labour and sexual exploitation, promoting human rights and democracy, protecting the environment, and controlling population growth. Increasingly, education is recognised as one of the best financial investments States can make. But the importance of education is not just practical: a well-educated, enlightened and active mind, able to range freely and widely, is one of the joys and rewards of human existence.

Education is [acceptable] when the form and substance of education, including curricula and teaching methods are relevant, culturally appropriate and of good quality to students and, in appropriate cases, parents; and it is [adaptable] when it is flexible so it can meet the needs of changing societies and communities and respond to the needs of students within their diverse social and cultural settings.”¹

2 Survey Methodology

The Naledi 3d Factory conducted subjective surveys of teachers and students, from secondary schools and multi-purpose centres in both Uganda and South Africa.

The rationale behind the survey methodology and also the survey forms used (designed by Rita Kizito of UNISA - an educational specialist) are attached as Annex 5, 6 and 7 to this report. These were based on the requirement to assess whether using visually interactive interventions can potentially have a positive impact on student learning.

This would be achieved by mapping out the *perceived value* and *initial impact* of Virtual reality (VR) on student learning in different African learning contexts by focussing on the following questions:

- Does VR affect the understanding of the topic being taught?
- Does use of VR affect learning retention?
- Does use of VR influence motivation towards learning?
- Is there any evidence of the application of the knowledge learnt after using VR?

¹ South African Human Rights Commission. - 4th Economic and Social Economic Reports - 4th - 2000/2002

The Institutions surveyed were:

Country	Institution	# Scholars	# Teachers
Uganda	Buwana t/centre	17	1
	Nakaseke t/centre	45	7
	Kings College Budu Secondary School	25	1
	Makerere College School	19	7
	Mengo Secondary School	20	2
	Ndejje Secondary School	26	5
	St Henry's Secondary School	29	6
South Africa	Soshanguve High School	28	1
	Mamelodi High School	71	2
Total		280	32

Questionnaire Part A (Pre VR Demonstration): The first step in each of the survey sessions was to ask a range of questions to assess their exposure to computer based learning, as well as the subject material, before being exposed to the eight VR models themselves.

Questionnaire Part B (Post VR Demonstration): Exposure to the eight VR models took the form of a series of simulated teaching lessons. Their opinions of this material, which was subsequently surveyed through a series of questions designed to test their responses to the visual learning material; where they had difficulties; and a series of open-ended questions to obtain ideas on what could be done to make the learning easier.

The models used as part of the simulated lesson on each of the subject areas were:

Title	Description	Comments
Sand filter	What a sand-based water filter is, how it operates. Allows the user to build a water filter by selecting sand layers and tests for correctness.	
Plastic moulder	Shows how a low-cost single phase plastic moulding machine works. Allows the user to go through the moulding steps in real-time.	Resulted in a Community leader in Buwama tele-centre wanting to source a machine for the community.
Gun	A good example of a machine, which can be taken apart and the audience can see how this particular machine works, in this case, the firing pin. Being pushed by a spring mechanism.	
Lalibela	A model that shows a rock hewn church in Lalibela, Ethiopia (Bet St Giorgis) ; both an external and internal tour.	Children in particular didn't recognise the name, but as soon as they saw the model, recognised it as something they saw on the Internet.
Levers	A model (developed for IICBA) that shows the principles of 1 st -class; 2 nd -class and 3 rd -class levers.	
French	Developed in Uganda, this model (a living room) facilitates the learning of French pronunciation and vocabulary.	
Steam locomotive	A model developed for Delft Museum of Technology shows how a steam locomotive works. Encourages the user to assemble the five main components of a steam loco.	
Rural Hygiene	Developed with UNESCO for Nakaseke in Uganda. Basic-hygiene (including washing hands, washing fruit, smoking the toilet, bathing in the right area etc. A 3d village is used as a base model.	This model was commonly related to , especially with rural learners.

Questionnaire Part C (About the VR Lesson): This section followed on from the previous Section B and tested the respondents' opinions on VR as a potential learning tool.

Questionnaire Part D (about yourself): was used to obtain demographics of the respondent.

In summary, the sample contains individuals from rural communities; townships and cities over a fairly wide age spread (10 to 25+).

Students demographics - 280 respondents

Age		Location of school		Gender	
Below 10	0.97%	Rural Community	30.43%	Female	37.13%
2=11 to 14	8.41%	Township	53.51%	Male	62.87%
3=15 to 19	72.17%	City	16.06%		
4=20 to 24	8.74%				
5= above 25	9.71%				

Teacher demographics - 32 respondents

Age		Extent of VR training		Teaching experience	
1 = 20 to 24	14%	1 = extensive	0%	Mean number of years	7.2 years
2 = 25 to 34	40%	2 = adequate	15%	Median	5 years
3 = 35 to 44	30%	3 = very little	26%		
4 = 45 to 54	8%	4 = none	59%		
5 = above 55	8%				

Gender	
Male	81%
Female	19%

In total, written feedback was obtained from 323 students and 31 teachers. Some questions were not answered by all respondents.

3 Analysis of survey results

This section analyses in detail, the aggregate data obtained from all students and teachers that completed our questionnaire. Where possible, the data has been represented in a graphical format to facilitate interpretation.

The accompanying analysis sheets contained in Annex 1 to 4 contain the aggregated responses from:

- All Ugandan teachers
- All South African teachers
- All Ugandan students and
- All South African students.

The individual schools data and results have been separately bound as “*3d Interactive visual simulations (VR) as an aid to learning in Africa – VR survey Analyses: School Responses*”

3.1 Findings –Pre-and Post VR Evaluation: Students’ Confidence in Topics & Classroom Experience

3.1.1 Confidence in each of the topics before and after the VR lesson

There was a very significant shift in the students’ confidence levels in each of the subject areas after viewing the visual / VR learning material.

Before being exposed to the material, there was “little confidence” or “no confidence” in most of the topics shown. After being exposed to the VR learning material, the responses typically were “very confident”, “confident” or “some confidence”.

The results of the before and after responses are shown in the Table below.

Pre-VR Session					Post-VR Session				
Question: <i>How confident are you about the following topics?</i>	No	Mean	St. Dev.	Median	Question: <i>How confident are you about the following topics?</i>	No	Mean	St. Dev.	Median
A1.1 – Sand-filter	311	4.1	1.3	5	B1.1	297	2.2	1.0	2
A1.2 – Plastic Moulder	303	4.4	1.0	5	B1.2	290	2.5	1.1	2
A1.3 – Gun	312	3.5	1.3	4	B1.3	297	2.0	1.1	2
A1.4 – Lalibela	302	4.6	0.9	5	B1.4	286	2.6	1.3	3
A1.5 – Levers	307	3.8	1.4	4	B1.5	295	1.9	1.1	2
A1.6 – French	310	4.4	0.9	5	B1.6	288	3.2	1.1	3
A1.7 – Steam Locomotive	298	4.6	0.8	5	B1.7	285	3.0	1.2	3
A1.8 – Rural Hygiene	242	3.3	1.5	3	B1.8	218	1.5	0.8	1

1 = Very confident; 2 = confident; 3 = some confidence; 4 = little confidence; 5 = no confidence

Clearly, the level of confidence in knowledge of the subject matter has increased significantly. VR also seems to be capable of tackling a wide range of subjects, including traditionally “difficult” subjects such as languages. The French language model elicited one of the poorer responses, but still increased from 5 (no confidence) to 3 (some confidence). This underscores the flexibility of the technology and its broad range of application areas.

3.1.2 Rating the experience

On average, students felt that the VR experience was “highly satisfactory” to “satisfactory”. This underscores the fun element in VR learning. Whereas many students can find traditional teaching methods boring and not particularly stimulating, VR learning materials demand constant student input and participation, but also retain attention and motivation, thus challenging the learner more.

Question	# Responses	Mean	St. Dev.	Median
How would you rate your experience?	190	1.7	0.9	2

1=extremely enjoyable; 2=satisfactory; 3=not enjoyable

3.1.3 A Comparison between Ugandan and South African Students

- Both countries’ students displayed similar levels of pre- and post-VR confidence.
- South African students had slightly more difficulty (83% of respondents) than the Ugandans (72% of the respondents) with the topics concerned. See responses to question 2 a) in Section A of annexes 3 and 4.

There is little difference in learners’ experience of VR from one African country to the next, which points to the possibility and usefulness of increased sharing of VR models within Africa.

3.2 Findings - Post VR Demonstration: Teachers' Rating of VR Software

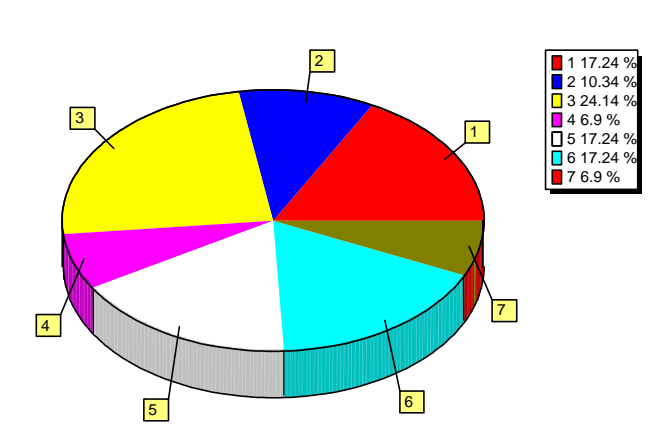
Teachers were asked to rate the VR software, the VR lesson and their experience of using VR as teaching tool.

- Teachers rated the usability, layout, academic content and attainment of learning objectives as good to excellent.

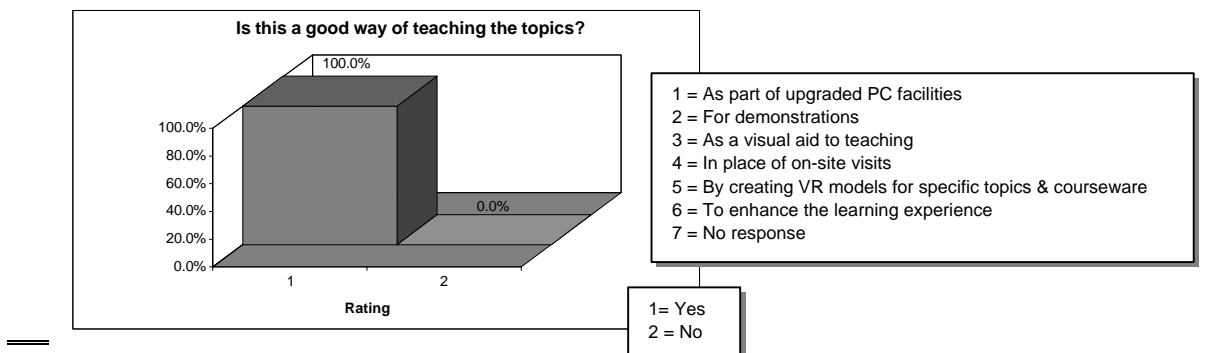
Question: <i>How would you rate the following:</i>	No	Mean	St. Dev.	Median
A1. Usability	31	7.9	1.6	8
A2. Layout	31	8.6	1.5	9
A3. Academic Content	30	8.1	1.4	9
A4. Attainment of learning Objectives	30	8.7	1.3	9

Rated from **1 = poor** through to **10 = excellent**

- All respondents indicated that VR could be used as part of their courses or lessons. How this could be achieved is reflected in the following pie chart.



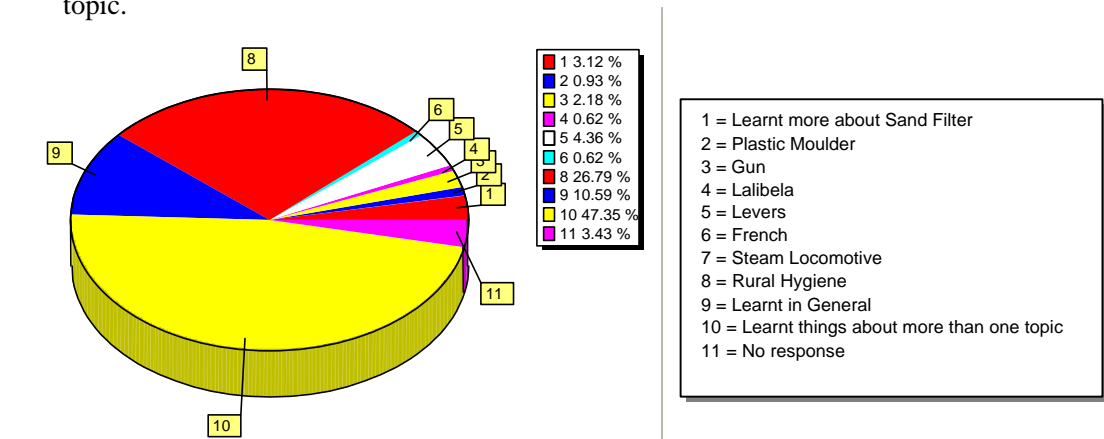
- All teachers interviewed (100%) also indicated that this was a good way of teaching subject material.



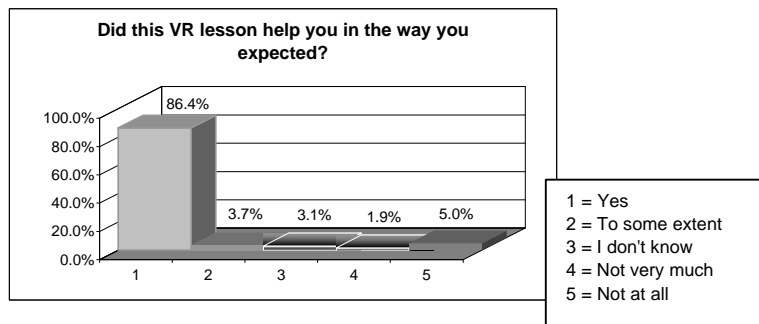
3.3 Findings - Post VR Demonstration: Students' Learning Experience

3.3.1 Views on the extent and value of the learning obtained from the demonstration

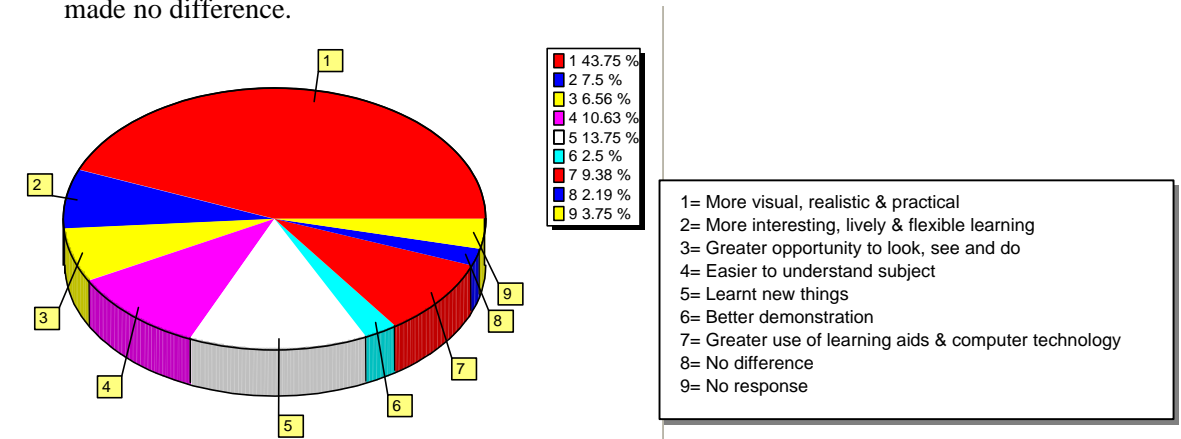
- Overall, 47% of the students learnt about more than one topic. Interestingly, 27% of the students indicating that Rural Hygiene was the most important topic they learnt about, although almost half (47%) indicated that they learnt about more than one topic.



- 86% of students said that the VR lesson had helped in the way they had expected.



- 44% of students said that the VR lessons were more practical, realistic and visual than normal lessons. Another 50% of the respondents said they learnt new things and that the lessons were more interesting, lively & flexible, etc. Only 2% said that VR made no difference.



3.3.2 A Comparison between Ugandan and South African Students

- Interestingly, 50% of South African students felt that the rural hygiene VR model provided the most important learning experience. 30% of the South Africans learnt things about more than one topic compared to 62% of the Ugandans students.
- 85% of both Ugandan and South African students said that the VR lesson had helped in the way they had expected.
- 40% plus of both Ugandan and the South African students said that the VR lessons were more practical, realistic and visual than normal lessons, they learnt new things, it was a better demonstration of the subject; and finally, a better use of learning aids & computer technology was experienced.
- 37% of SA students had difficulty with only one topic after the VR lessons and 17% still had difficulty with two topics. 25% of the students had no difficulty at all after the lessons. In Uganda only 29% still had difficulty with one topic whilst 20% had difficulty with two topics. 13% of the Ugandan students had no difficulty at all.

3.4 Students' Assessment of VR Lessons

3.4.1 The quality of the VR lesson overall

- Students were asked to rate the VR lesson in terms of the following criteria.

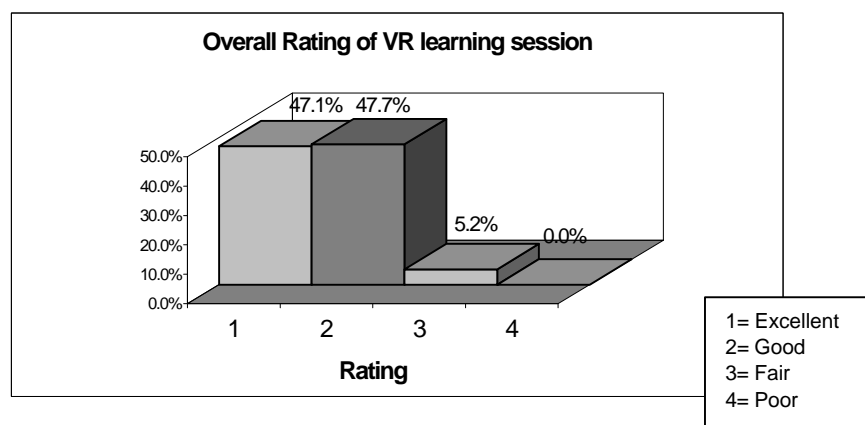
Questions	# of responses	Mean	St. Dev.	Median
C1.1 - The computer visuals make the learning easier	301	1.3	0.5	1
C1.2 - I understand better with the computer visuals	300	1.8	0.9	2
C1.3 - I understand better without the computer visuals	290	3.8	1.1	4
C1.4 - It is the teacher's explanation which makes me understand	286	2.4	1.0	2
C1.5 - The computer visuals make the learning more enjoyable	289	1.4	0.8	1
C1.6 - The computer visuals complicate the learning process	276	3.8	1.4	4
C1.7 - The computer visuals help me to remember what I have learnt	289	1.7	0.9	2
C1.8 - The VR session cannot help me revise the topic	288	3.9	1.2	4
C1.9 - This VR session fits well with the rest of my lessons	280	2.0	1.0	2
C1.10 – Given the opportunity, I would like to have another VR	296	1.4	0.9	1

Rating: 1= strongly agree, 2=agree, 3=neutral, 4=disagree, 5=strongly disagree

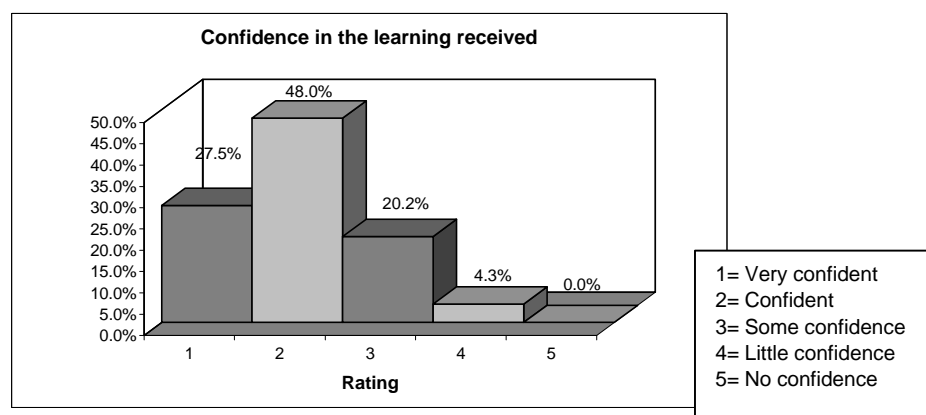
The above responses speak for themselves.

However, within the 10 questions, there are three which test for opposite responses (C1.3; C1.6; and C1.8). There was a concern that due either to a weaker understanding of English, or through the respondent quickly filling in answers, that the subtle opposite nature of these questions would be missed, especially with the younger students. It is encouraging, and a reflection of the effort the respondents put to their answers that the opposite meaning was picked up and responded to accordingly.

- Students were asked to provide an overall rating of the VR lesson.



- Students also rated the lesson in terms of the learning received.



3.4.2 A Comparison between Ugandan and South African Students

- Both the Ugandan and the South African students responded in similar fashion. The overall response to the VR lesson was very positive.
- The majority of both countries' students rated the VR lesson as good to excellent.
- In South Africa 32% of the students were very confident after the VR lesson, whereas a further 49% felt confident in the concepts learnt. In Uganda 21% of the students expressed high confidence and 48% expressed confidence in the concepts learnt.

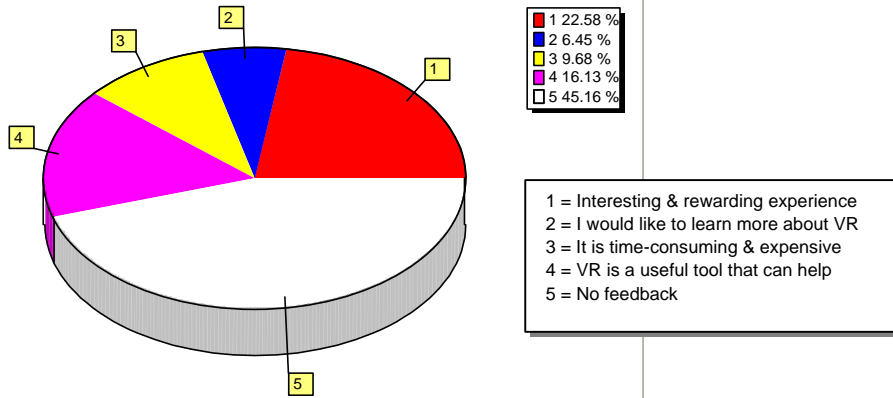
3.5 Teachers' Assessment of VR Lessons

Teachers were asked to assess the quality of the VR lesson overall, using a number of criteria, as shown in the following Table:

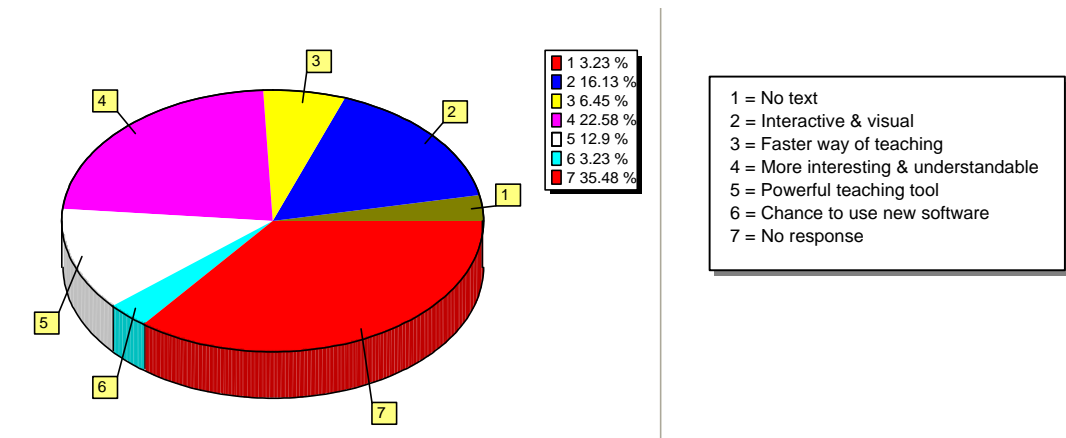
Questions	# of Response	Mean	St. Dev.	Median
B1 - The preparation for this VR lesson was easy	28	2.8	1.3	2.5
B2 - I feel confident using this method to teach	28	2.0	1.1	2.0
B3 - My students enjoyed the VR lesson	28	1.8	1.1	2.0
B4 - The material was challenging for my students	27	2.7	1.3	3.0
B5 - The teaching time using VR was less than for my normal lessons	25	2.2	1.0	2.0
B6 - VR can be useful for learners with difficulties in the topics	29	1.6	0.9	1.0
B7 - It is easy to integrate the VR lesson into my course	28	1.9	0.9	2.0
B8 - The VR session can help with the revision of the topics	28	1.6	1.0	1.0
B9 - This software can be used in more than one course	28	1.6	0.8	1.0
B10 - I would like to use VR more often	29	1.8	0.9	2.0
B11 - VR Lessons are too expensive	26	2.3	1.3	2.0

Rating: 1= Strongly agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly disagree

- Teachers were also asked to comment (in their own words) on their experience of teaching with VR.



- Teachers were then asked (again, in their own words) to highlight the best aspect of the lesson



4 Summary

This section highlights the most important conclusions to be drawn based on the available data for both students and teachers.

4.1 Students' Rating of the VR Lesson

The students felt that the computer visuals made the learning easier, the topic easier to understand, learning more enjoyable, learning easier to remember, fitted in well with other lessons and helps with the revision of topics. In addition, more than 90% of the students rated the VR lesson as good to excellent.

4.2 Teachers' Rating of the VR Lesson

Overall, the teachers felt confident that VR was an effective teaching tool that could be integrated into courses. All teachers believed VR offered a good way of teaching the topics concerned.

There was a strong correlation between teachers and students in that both groups agreed that the VR lessons were enjoyable, easy to integrate into courses and could help with the revision of topics. 76% of the students felt confident to very confident in the learning received. Both groups also agreed that the software could be used in more than one course. 47% of the students learnt things about more than one topic.

There was an indication that software and hardware expenses and lesson preparation might be an issue. This may be due to a shortage of computers in schools and the anticipated cost of rectifying the problem.

As to lesson preparation, one can expect an initial learning curve for teachers as they adopt VR as a teaching tool (experience in previous projects in Uganda with the UNESCO National Commission show that there are ways to overcome this entry barrier).

4.3 Rating of the VR Software

Teachers rated the usability, layout, academic content and attainment of learning objectives as good to excellent. This correlates strongly with the students' responses, 95% of whom rated the VR session as good to excellent.

Here again, there was a strong correlation between the teachers' and the students' experiences. The three most important needs that came to the fore were:

1. the shortage of computer equipment;
2. clear instruction/teaching; and
3. training.

- 19% of both students and teachers indicated that better equipment, software, etc. was required;
- 19% of both students and teachers said that more lessons, practice and training were required;
- 23% of teachers and 14% of students wanted clearer instruction, guidance and teaching.

There is clearly a need for more computers in schools, which strongly relates to the apparent lack of computers already mentioned.

More than 24% of teachers felt that VR could be used as a visual aid to teaching. This correlates strongly with the response from students where 44% felt VR was more visual, realistic and practical than their normal lessons.

17% emphasized the importance of making the acquisition and installation of VR software an integral part of the upgrading of computer facilities.

Other aspects that came to the fore were the belief that VR could enhance the learning experience (17% of respondents) and that VR models should be created for specific topics (again, 17% of respondents).

All teachers (100%) believed VR was a good way of teaching the topics concerned. 86% of the students said the VR lesson helped in the way they had expected.

4.4 Experience of Teachers with VR

Overall the experience was a positive one with nearly 40% of the teachers rating VR as interesting, rewarding and useful in their teaching, even though there was strong indication that the perceived costs involved in getting computer hardware and developing VR models was for some, too high.

What stood out for nearly 40% of the teachers was that VR lessons were more interesting, understandable, visual and interactive. This correlates strongly with 44% of the students who rated the visual, realistic and practical aspects as being the major differences from normal lessons.

However, 26% of the teachers thought that VR was complex to learn. This would seem to indicate that there is a learning curve to be addressed, especially in the teacher community.

Both teachers (16%) and students (19%) said they needed better training to use VR models to improve their experience of VR.

10% of teachers felt that the VR models should make more use of African languages. Obviously locally developed African content will have to cater to the language needs of students.

5 Conclusion

This field study has confirmed the findings of our previous, theoretical research as contained in the first part of this VR Evaluation “*3d Interactive visual simulations (VR) as an aid to learning in Africa – An Evaluation*”

The data analysed and represented in this report confirms the previous findings that VR is a powerful new educational tool. Responses of both teachers and students show that the learning process can be greatly enhanced by the use of VR learning materials.

All teachers believed VR was a good teaching medium and most of the teachers indicated that they could integrate VR into their lessons.

The majority of students benefited from the visual and interactive power of the technology thus leaving them more confident in respect of the subjects concerned. This is very encouraging given the relatively brief exposure to each VR model and underscores the speed and ease of learning associated with VR.

There are also challenges in implementing this technology in Africa. One of the problems that came out clearly in the study is the lack of computer equipment in many schools. Obviously, computer hardware and software shortages need to be addressed to roll out VR to educational institutions.

Additionally, due to the differences between VR and traditional teaching methods, teachers face a learning curve in respect of using the technology.

Finally, the importance of having African VR learning material in local African languages cannot be overemphasised. To unlock the full potential of VR in African education requires locally developed content.

Annexures

Annexes 1 to 4	Detailed Survey results at the aggregate level for: <ul style="list-style-type: none">• All Teachers• All Schools• All Ugandan Schools• All South African Schools.
Annexure 5	Evaluation methodology for analysing the usefulness of visually interactive training material in different learning contexts.
Annexes 6 & 7	Survey forms used for: <ul style="list-style-type: none">• Teachers• Students

The individual schools data and results have been separately bound as “*3d Interactive visual simulations (VR) as an aid to learning in Africa – VR survey Analyses: School Responses*”



ANNEX 1 - Statistical Analyses – All Teachers

Section A: Rating of VR Software

1. How would you rate the VR software packages in terms of:

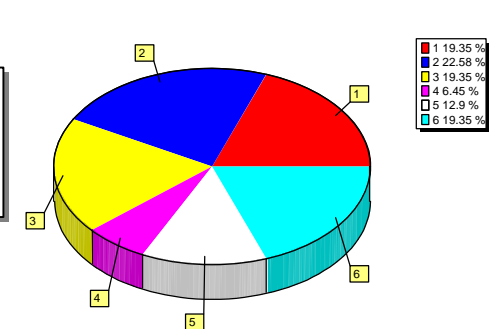
Rated from 1 = Poor through to 10 = Excellent

Question: <i>How would you rate the following:</i>	No	Mean	St. Dev.	Median
A1. Usability	31	7.9	1.6	8
A2. Layout	31	8.6	1.5	9
A3. Academic Content	30	8.1	1.4	9
A4. Attainment of Learning Objectives	30	8.7	1.3	9

- The mean value represents the average value obtained for the particular response
- The standard deviation is an indication of how closely values are clustered around the mean.
- The median represents the middle value.
 - If the median is smaller than the mean, this indicates that most values are smaller than the mean while a few values are much larger than the mean.
 - If the median is larger than the mean, this indicates that most values are larger than the mean while a few values are much smaller than the mean

5. What kind of additional support would be required for students to work through the package by themselves?

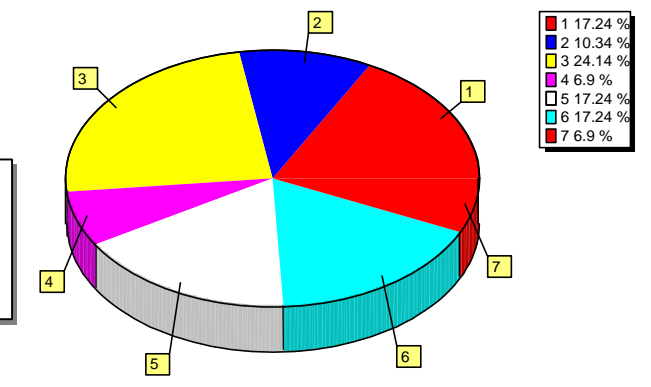
- | |
|--|
| 1 = Provide computer hardware, software & peripherals
2 = Provide clear instructions, guidance and explanations
3 = Provide more training
4 = Explain the relevance of VR to learning
5 = No response
6 = More reference material |
|--|



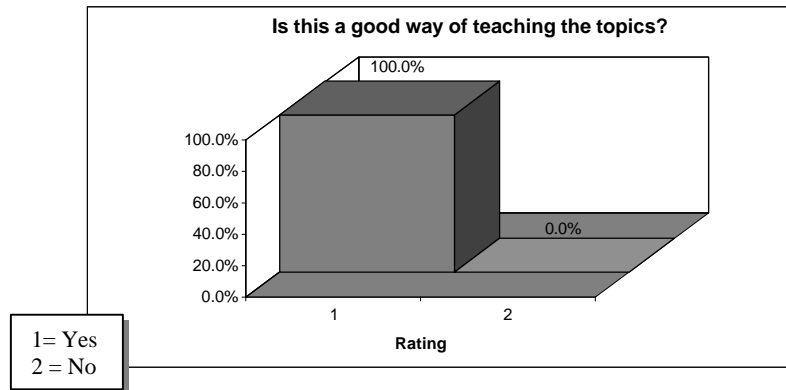
6. Could this VR software be used as part of your courses/lessons and if so, how?

All 31 respondents indicated that VR could be used as part of their courses or lessons. How this could be achieved is reflected in the pie chart.

- | |
|---|
| 1 = As part of upgraded PC facilities
2 = For demonstrations
3 = As a visual aid to teaching
4 = In place of on-site visits
5 = By creating VR models for specific topics & |
|---|



7. **Is this a good way of teaching the topic?**



Section B : About the VR Lesson

1. **To what extent do you agree with the descriptions of the VR lesson?**

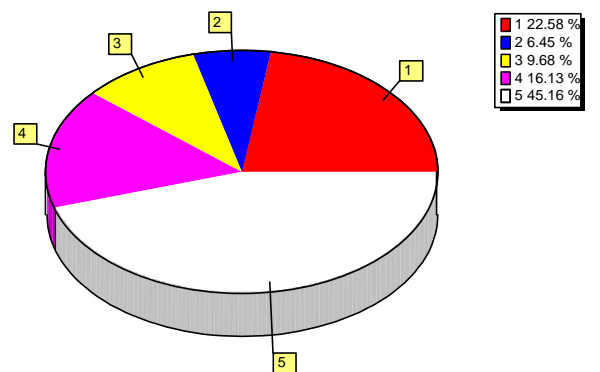
Questions	# of Responses	Mean	St. Dev.	Median
B1 - The preparation for this VR lesson was easy	28	2.8	1.3	2.5
B2 - I feel confident using this method to teach	28	2.0	1.1	2.0
B3 - My students enjoyed the VR lesson	28	1.8	1.1	2.0
B4 - The material was challenging for my students	27	2.7	1.3	3.0
B5 - The teaching time using VR was less than for my normal lessons	25	2.2	1.0	2.0
B6 - VR can be useful for learners with difficulties in the topics	29	1.6	0.9	1.0
B7 - It is easy to integrate the VR lesson into my course	28	1.9	0.9	2.0
B8 - The VR session can help with the revision of the topics	28	1.6	1.0	1.0
B9 - This software can be used in more than one course	28	1.6	0.8	1.0
B10 - I would like to use VR more often	29	1.8	0.9	2.0
B11 - VR Lessons are too expensive	26	2.3	1.3	2.0

Rating: 1= Strongly agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly disagree

Section C: Teacher's experience of using VR

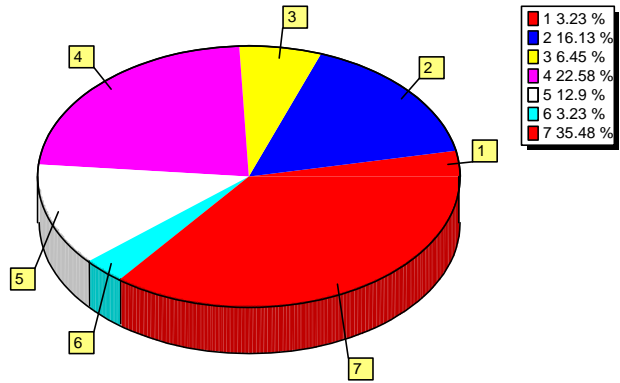
1. **Comment on your experience of teaching with VR.**

1 = Interesting & rewarding experience
 2 = I would like to learn more about VR
 3 = It is time-consuming & expensive
 4 = VR is a useful tool that can help
 5 = No feedback



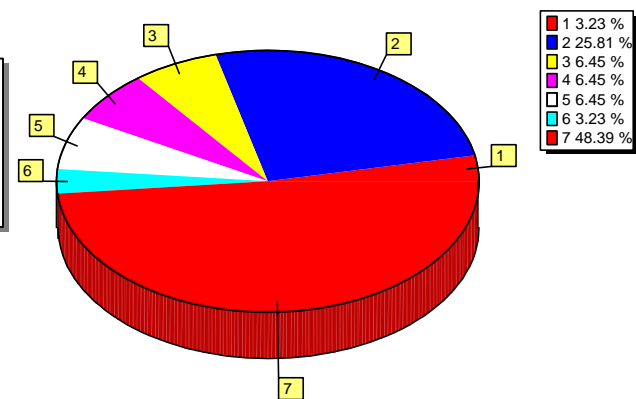
2. What was good about it?

- 1 = No text
- 2 = Interactive & visual
- 3 = Faster way of teaching
- 4 = More interesting & understandable
- 5 = Powerful teaching tool
- 6 = Chance to use new software
- 7 = No response



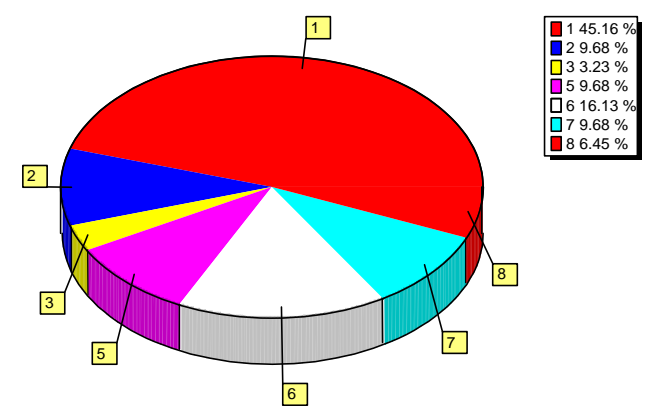
3. What was bad about it?

- 1 = Nothing
- 2 = Complex to learn to use
- 3 = Requires special computer equipment
- 4 = Could discourage real-life experimentation
- 5 = Not proven technology
- 6 = VR models should be more African
- 7 = No response



4. How can it be improved?

- 1 = No suggestions
- 2 = Make less complex models
- 3 = Use more video clips
- 4 = Include more African content
- 5 = Use more African languages
- 6 = Better training to use VR models
- 7 = Combine theory with VR learning
- 8 = Provide VR software



Section D: Teacher assessment of student work

None of the 31 respondents provided any assessments of the student learning and performance for the topics covered.

Section E: Your attributes

What is your age?	
1 = 20 to 24	14%
2 = 25 to 34	40%
3 = 35 to 44	30%
4 = 45 to 54	8%
5 = above 55	8%

What VR training do you have?	
1 = extensive	0%
2 = adequate	15%
3 = very little	26%
4 = none	59%

What is your sex?	
Male	81%
Female	19%

How many years of teaching experience do you have?	
Mean number of years	7.2 years
Median	5 years



ANNEX 2 -Statistical Analyses – All Students

Section A: Pre-VR Session Questions

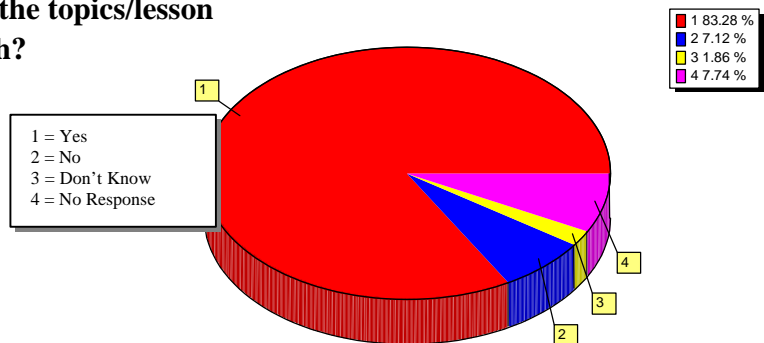
1. How confident are you about each of the topics?

1 = Very Confident; 2 = Confident; 3 = Some Confidence; 4 = Little Confidence; 5 = No Confidence

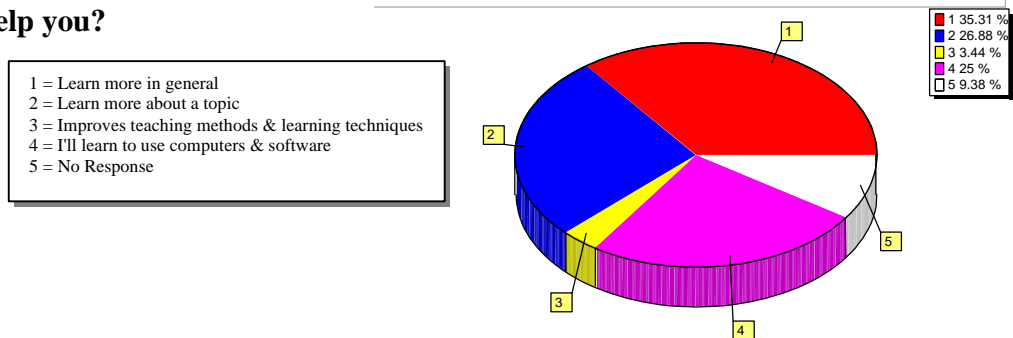
Pre-VR Session					Post-VR Session				
Question: <i>How confident are you about the following topics?</i>	No	Mean	St. Dev.	Median	Question: <i>How confident are you about the following topics?</i>	No	Mean	St. Dev.	Median
A1.1 – Sand-filter	311	4.1	1.3	5	B1.1	297	2.2	1.0	2
A1.2 - Plastic Moulder	303	4.4	1.0	5	B1.2	290	2.5	1.1	2
A1.3 - Gun	312	3.5	1.3	4	B1.3	297	2.0	1.1	2
A1.4 - Lalibela	302	4.6	0.9	5	B1.4	286	2.6	1.3	3
A1.5 - Levers	307	3.8	1.4	4	B1.5	295	1.9	1.1	2
A1.6 - French	310	4.4	0.9	5	B1.6	288	3.2	1.1	3
A1.7 - Steam Locomotive	298	4.6	0.8	5	B1.7	285	3.0	1.2	3
A1.8 - Rural Hygiene	242	3.3	1.5	3	B1.8	218	1.5	0.8	1

- The mean value represents the average value obtained for the particular response
- The standard deviation is an indication of how closely values are clustered around the mean.
- The median represents the middle value.
 - If the median is smaller than the mean, this indicates that most values are smaller than the mean while a few values are much larger than the mean.
 - If the median is larger than the mean, this indicates that most values are larger than the mean while a few values are much smaller than the mean

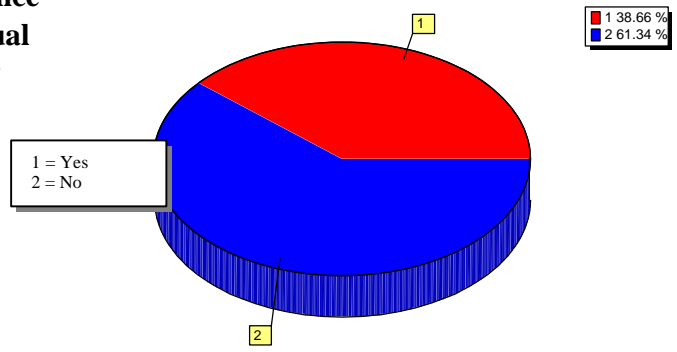
2a) Are there any parts of the topics/lesson you have difficulty with?



2b) How do you hope this session will help you?



3a) **Have you had any experience using computer-based visual learning materials before?**



3b) **What was your level of participation?**

Question	# Responses	Mean	St. Dev.	Median
What was your level of participation?	145	1.9	0.7	2

1=Minimal (teacher used the computer); 2=Average (occasional use) ; 3=High (students allowed access to computer)

3c) **How would you rate your experience?**

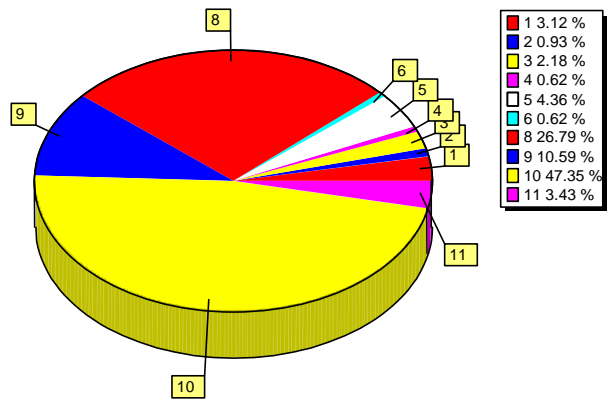
Question	# Responses	Mean	St. Dev.	Median
How would you rate your experience?	190	1.7	0.9	2

1=Extremely enjoyable; 2=Satisfactory; 3=Not enjoyable

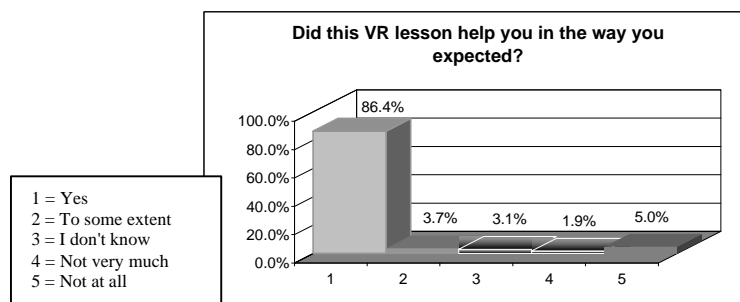
Section B: Post –VR Session Questions

1. **What do you think was the most important thing you learnt about each of the seven topics?**

- 1 = Learnt more about Sand Filter
- 2 = Plastic Moulder
- 3 = Gun
- 4 = Lalibela
- 5 = Levers
- 6 = French
- 7 = Steam Locomotive
- 8 = Rural Hygiene
- 9 = Learnt in General
- 10 = Learnt things about more than one topic
- 11 = No response



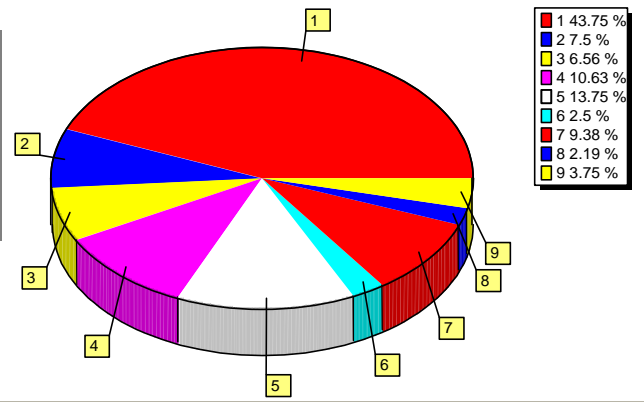
2. **Did this VR lesson help you in the way you had expected?**



- 1 = Yes
- 2 = To some extent
- 3 = I don't know
- 4 = Not very much
- 5 = Not at all

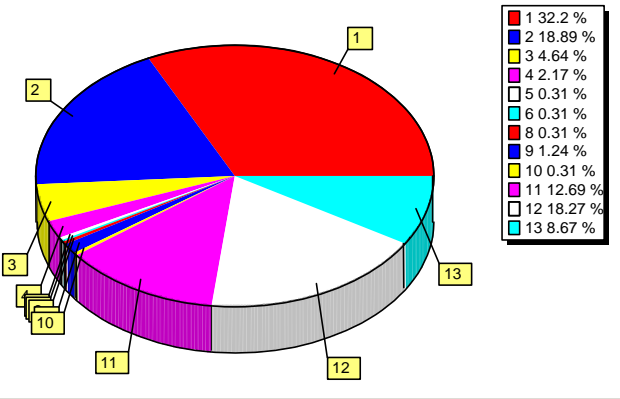
3. How was the VR lesson different from your normal lessons?

- 1= More visual, realistic & practical
- 2= More interesting, lively & flexible learning
- 3= Greater opportunity to look, see and do
- 4= Easier to understand subject
- 5= Learnt new things
- 6= Better demonstration
- 7= Greater use of learning aids & computer technology
- 8= No difference
- 9= No response



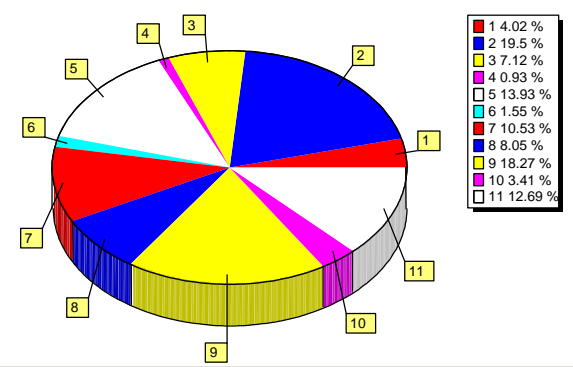
4a) Are there any parts in the learning units you still have difficulty with?

- 1= Difficulty with only one subject
- 2= Difficulty with only two subjects
- 3= Difficulty with three subjects
- 4= Difficulty with four subjects
- 5= Difficulty with five subjects
- 6= Difficulty with six subjects
- 7= Difficulty with seven subjects
- 8= Difficulty with all subjects
- 9= Difficulty with interface
- 10= Learning isn't hands on
- 11= Miscellaneous difficulties
- 12= No difficulty
- 13= No response



4b) What should be done or provided to make your learning easier?

- 1= Translate material into local languages
- 2= Provide better/more equipment & facilities
- 3= Provide more detailed learning materials
- 4= Adapt learning material to African setting
- 5= Use better teaching methods
- 6= Continue learning
- 7= More practice
- 8= Attend more lessons & seminars
- 9= No response
- 10= Nothing
- 11= Use VR in Schools



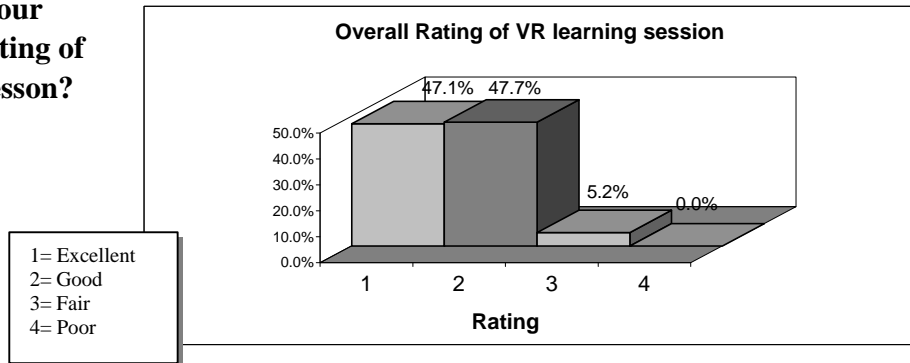
Section C: About the VR Lesson

1. To what extent do you agree with the descriptions of the VR lesson?

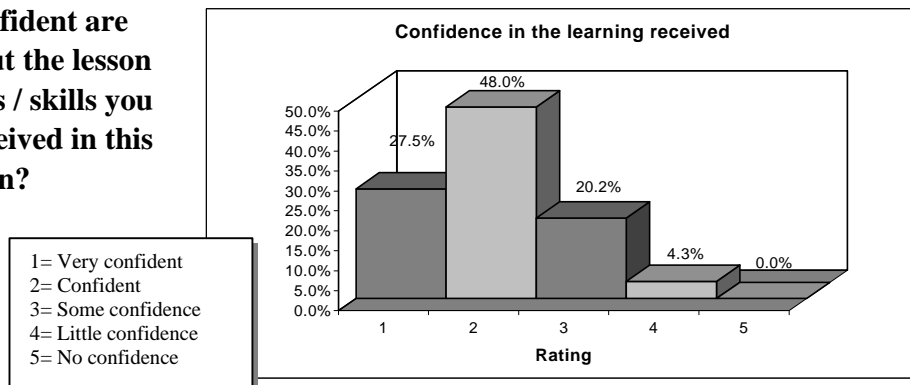
Questions	# of Responses	Mean	St. Dev.	Median
C1.1 - The computer visuals make the learning easier	301	1.3	0.5	1
C1.2 - I understand better with the computer visuals	300	1.8	0.9	2
C1.3 - I understand better without the computer visuals	290	3.8	1.1	4
C1.4 - It is the teacher's explanation which makes me understand	286	2.4	1.0	2
C1.5 - The computer visuals make the learning more enjoyable	289	1.4	0.8	1
C1.6 - The computer visuals complicate the learning process	276	3.8	1.4	4
C1.7 - The computer visuals help me to remember what I have learnt	289	1.7	0.9	2
C1.8 - The VR session cannot help me revise the topic	288	3.9	1.2	4
C1.9 - This VR session fits well with the rest of my lessons	280	2.0	1.0	2
C1.10 - Given the opportunity, I would like to have another VR lesson	296	1.4	0.9	1

Rating: 1= Strongly agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly disagree

2. What is your overall rating of this VR lesson?



3. How confident are you about the lesson Concepts / skills you have received in this VR lesson?



Section D: About Yourself (Demographics)

What is your age?

Below 10	0.97%
2=11 to 14	8.41%
3=15 to 19	72.17%
4=20 to 24	8.74%
5= above 25	9.71%

What is your sex?

Female	37.13%
Male	62.87%

What is the location of your school?

Rural Community	30.43%
Township	53.51%
City	16.06%



ANNEX 3 - Statistical Analyses – All Ugandan Schools

Section A: Pre-VR Session Questions

1. How confident are you about each of the topics?

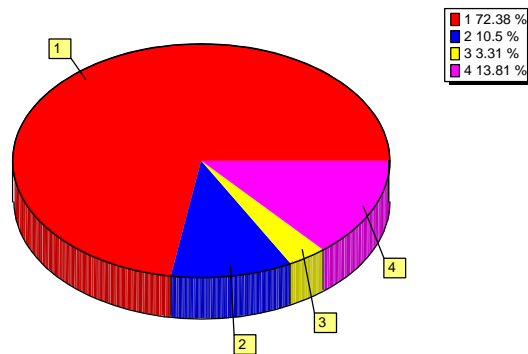
1 = Very Confident; 2 = Confident; 3 = Some Confidence; 4 = Little Confidence; 5 = No Confidence

Pre-VR Session					Post-VR Session				
Question: <i>How confident are you about the following topics?</i>	No	Mean	St. Dev.	Median	Question: <i>How confident are you about the following topics?</i>	No	Mean	St. Dev.	Median
A1.1 – Sand-filter	175	3.8	1.4	4	B1.1	169	2.0	1.0	2
A1.2 - Plastic Moulder	167	4.5	0.9	5	B1.2	164	2.5	1.2	2
A1.3 - Gun	170	3.8	1.3	4	B1.3	167	2.3	1.2	2
A1.4 - Lalibela	172	4.7	0.9	5	B1.4	162	2.6	1.3	2
A1.5 - Levers	171	3.3	1.4	3	B1.5	163	1.8	1.1	1
A1.6 - French	172	4.3	1.1	5	B1.6	158	3.3	1.1	3
A1.7 - Steam Locomotive	168	4.5	0.9	5	B1.7	153	3.1	1.2	3
A1.8 - Rural Hygiene	108	2.2	1.2	2	B1.8	86	1.4	0.8	1

- The mean value represents the average value obtained for the particular response
- The standard deviation is an indication of how closely values are clustered around the mean.
- The median represents the middle value.
 - If the median is smaller than the mean, this indicates that most values are smaller than the mean while a few values are much larger than the mean.
 - If the median is larger than the mean, this indicates that most values are larger than the mean while a few values are much smaller than the mean

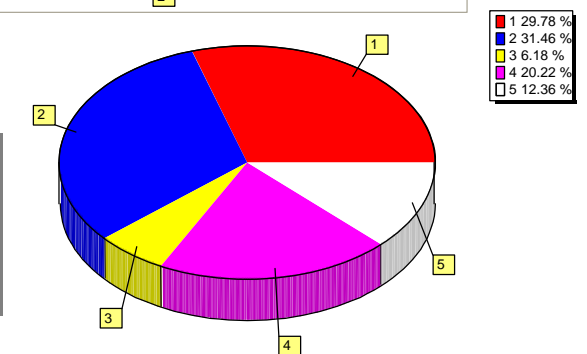
2a) Are there any parts of the topics/lesson you have difficulty with?

1 = Yes
2 = No
3 = Don't Know
4 = No Response

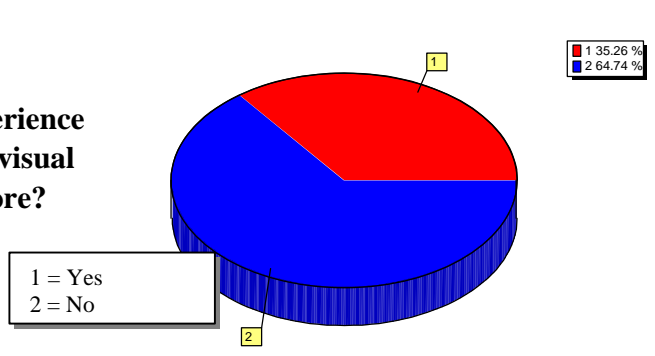


2b) How do you hope this session will help you?

1 = Learn more in general
2 = Learn more about a topic
3 = Improves teaching methods & learning techniques
4 = I'll learn to use computers & software
5 = No Response



3a) **Have you had any experience using computer-based visual learning materials before?**



3b) **What was your level of participation?**

Question	# Responses	Mean	St. Dev.	Median
What was your level of participation?	77	1.9	0.8	2

1=Minimal (teacher used the computer); 2=Average (occasional use); 3=High (students allowed access to computer)

3c) **How would you rate your experience?**

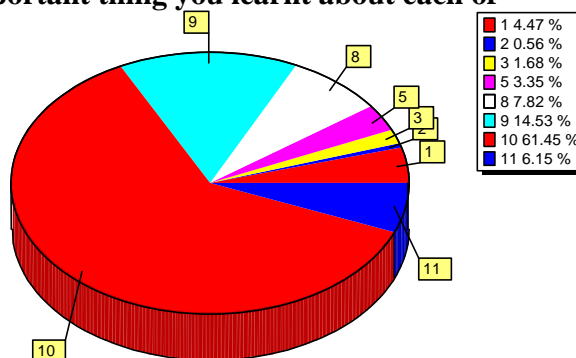
Question	# Responses	Mean	St. Dev.	Median
How would you rate your experience?	77	1.9	0.8	2

1=Extremely enjoyable; 2=Satisfactory; 3=Not enjoyable

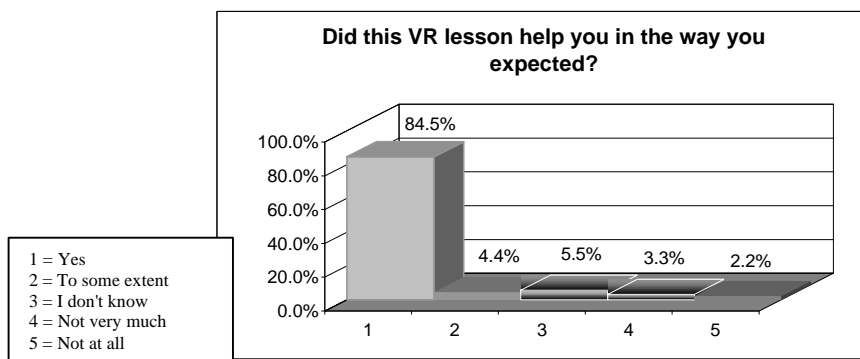
Section B: Post –VR Session Questions

1. **What do you think was the most important thing you learnt about each of the seven topics?**

- 1 = Learnt more about Sand Filter
- 2 = Plastic Moulder
- 3 = Gun
- 4 = Lalibela
- 5 = Levers
- 6 = French
- 7 = Steam Locomotive
- 8 = Rural Hygiene
- 9 = Learnt in General
- 10 = Learnt things about more than one topic
- 11 = No response

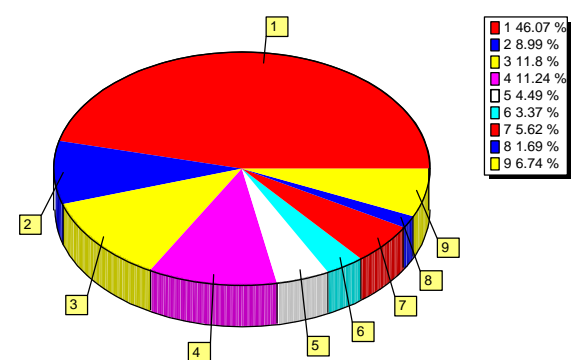


2. **Did this VR lesson help you in the way you had expected?**



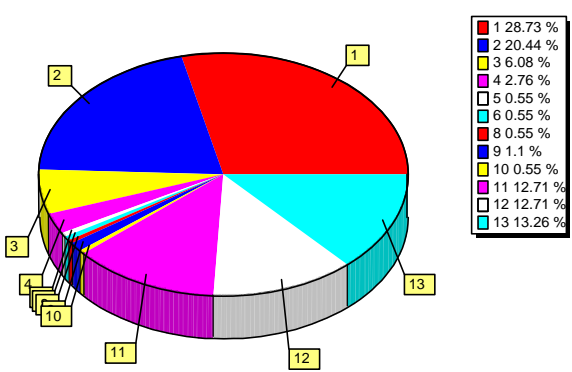
How was the VR lesson different from your normal lessons?

- 1= More visual, realistic & practical
- 2= More interesting, lively & flexible learning
- 3= Greater opportunity to look, see and do
- 4= Easier to understand subject
- 5= Learnt new things
- 6= Better demonstration
- 7= Greater use of learning aids & computer technology
- 8= No difference
- 9= No response



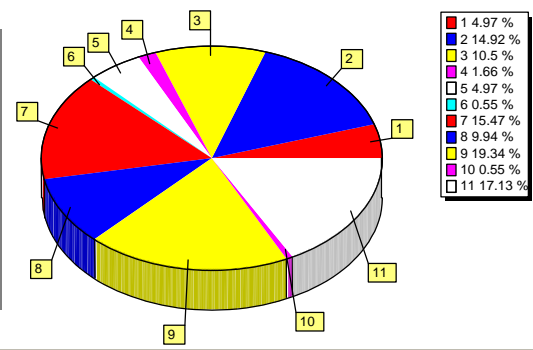
4a) Are there any parts in the learning units you still have difficulty with?

- 1= Difficulty with only one subject
- 2= Difficulty with only two subjects
- 3= Difficulty with three subjects
- 4= Difficulty with four subjects
- 5= Difficulty with five subjects
- 6= Difficulty with six subjects
- 7= Difficulty with seven subjects
- 8= Difficulty with all subjects
- 9= Difficulty with interface
- 10= Learning isn't hands on
- 11= Miscellaneous difficulties
- 12= No difficulty
- 13= No response



4b) What should be done or provided to make your learning easier?

- 1= Translate material into local languages
- 2= Provide better/more equipment & facilities
- 3= Provide more detailed learning materials
- 4= Adapt learning material to African setting
- 5= Use better teaching methods
- 6= Continue learning
- 7= More practice
- 8= Attend more lessons & seminars
- 9= No response
- 10= Nothing



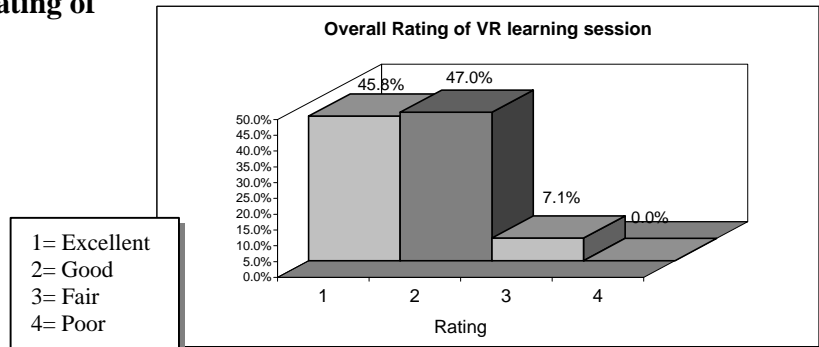
Section C: About the VR Lesson

1. To what extent do you agree with the descriptions of the VR lesson?

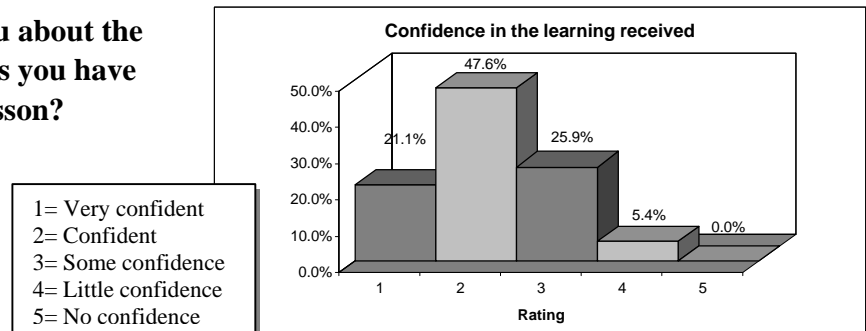
Questions	# of Responses	Mean	St. Dev.	Median
C1.1 - The computer visuals make the learning easier	159	1.2	0.5	1
C1.2 - I understand better with the computer visuals	158	1.8	1.0	2
C1.3 - I understand better without the computer visuals	148	4.0	1.1	4
C1.4 - It is the teacher's explanation which makes me understand	148	2.5	1.0	3
C1.5 - The computer visuals make the learning more enjoyable	149	1.5	0.9	1
C1.6 - The computer visuals complicate the learning process	140	4.1	1.3	5
C1.7 - The computer visuals help me to remember what I have learnt	147	1.6	1.0	1
C1.8 - The VR session cannot help me revise the topic	146	3.9	1.3	4
C1.9 - This VR session fits well with the rest of my lessons	142	2.1	1.1	2
C1.10 - Given the opportunity, I would like to have another VR lesson	154	1.4	0.8	1

Rating: 1= Strongly agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly disagree

2. What is your overall rating of this VR lesson?



2. How confident are you about the lesson Concepts / skills you have received in this VR lesson?



Section D About Yourself (Demographics)

Below 10	0.59%
2=11 to 14	2.37%
3=15 to 19	63.31%
4=20 to 24	15.98%
5= above 25	17.75%

Female	21.3%
Male	78.7%

Rural Community	43.03%
Township	36.36%
City	20.61%



ANNEX 4 -Statistical Analyses – All South African Schools

Section A: Pre-VR Session Questions

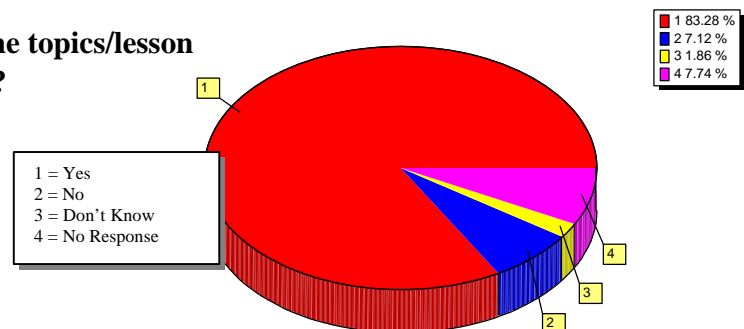
1. How confident are you about each of the topics?

1 = Very Confident; 2 = Confident; 3 = Some Confidence; 4 = Little Confidence; 5 = No Confidence

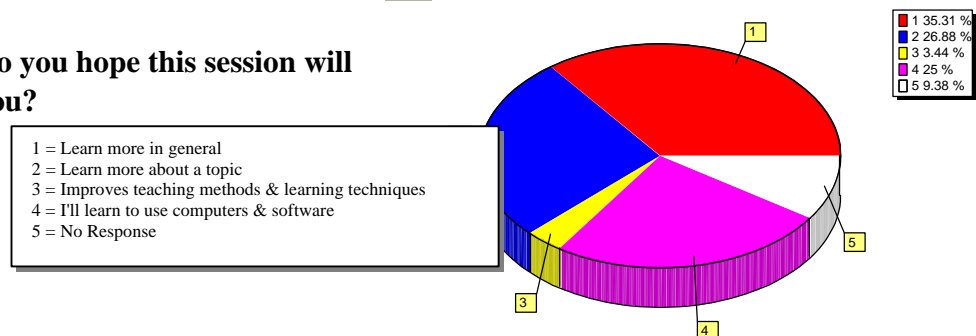
Pre-VR Session					Post-VR Session				
Question: <i>How confident are you about the following topics?</i>	No	Mean	St. Dev.	Median	Question: <i>How confident are you about the following topics?</i>	No	Mean	St. Dev.	Median
A1.1 – Sand-filter	136	4.6	0.9	5	B1.1	128	2.4	1.0	2
A1.2 - Plastic Moulder	136	4.4	1.0	5	B1.2	126	2.4	1.0	2
A1.3 - Gun	142	3.2	1.3	3	B1.3	130	1.6	0.7	1
A1.4 - Lalibela	130	4.6	1.0	5	B1.4	124	2.5	1.3	3
A1.5 - Levers	136	4.3	1.2	5	B1.5	132	2.0	1.0	2
A1.6 - French	138	4.6	0.6	5	B1.6	130	3.0	1.0	3
A1.7 - Steam Locomotive	130	4.7	0.7	5	B1.7	132	2.7	1.1	3
A1.8 - Rural Hygiene	134	4.1	1.2	5	B1.8	132	1.6	0.9	1

- The mean value represents the average value obtained for the particular response
- The standard deviation is an indication of how closely values are clustered around the mean.
- The median represents the middle value.
 - If the median is smaller than the mean, this indicates that most values are smaller than the mean while a few values are much larger than the mean.
 - If the median is larger than the mean, this indicates that most values are larger than the mean while a few values are much smaller than the mean

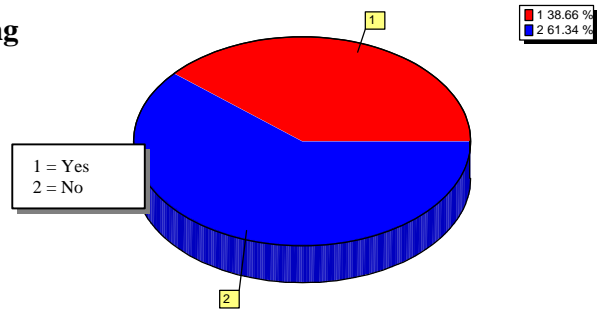
2a) Are there any parts of the topics/lesson you have difficulty with?



2b) How do you hope this session will help you?



3a) **Have you had any experience using computer-based visual learning materials before?**



3b) **What was your level of participation?**

Question	# Responses	Mean	St. Dev.	Median
What was your level of participation?	68	1.9	0.7	2

1=Minimal (teacher used the computer); 2=Average (occasional use) ; 3=High (students allowed access to ccomputer)

3c) **How would you rate your experience?**

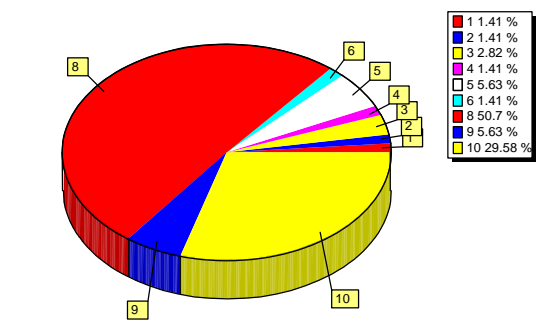
Question	# Responses	Mean	St. Dev.	Median
How would you rate your experience?	88	1.6	0.7	1.5

1=Extremely enjoyable; 2=Satisfactory; 3=Not enjoyable

Section B: Post –VR Session Questions

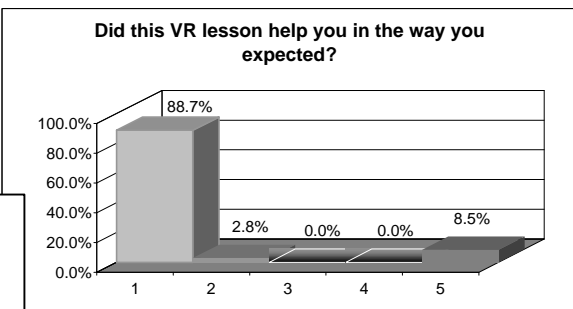
1. **What do you think was the most important thing you learnt about each of the seven topics?**

- 1 = Learnt more about Sand Filter
- 2 = Plastic Moulder
- 3 = Gun
- 4 = Lalibela
- 5 = Levers
- 6 = French
- 7 = Steam Locomotive
- 8 = Rural Hygiene
- 9 = Learnt in General
- 10 = Learnt things about more than one topic
- 11 = No response



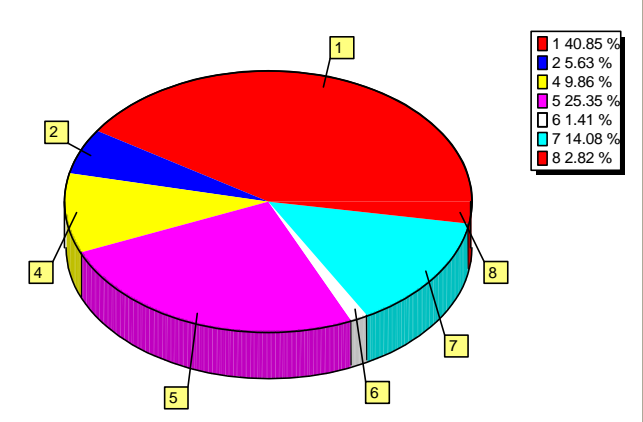
2. **Did this VR lesson help you in the way you had expected?**

- 1 = Yes
- 2 = To some extent
- 3 = I don't know
- 4 = Not very much
- 5 = Not at all



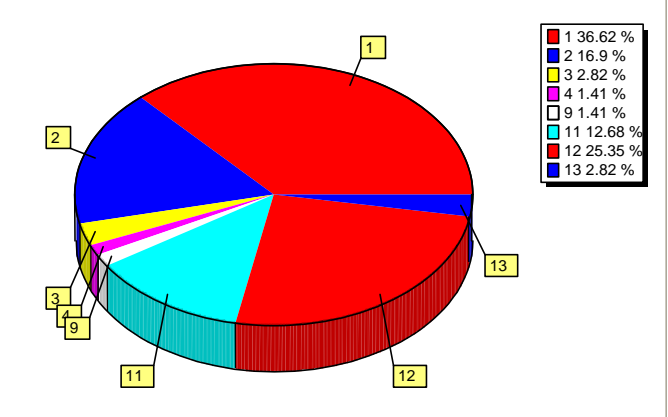
3. How was the VR lesson different from your normal lessons?

- 1= More visual, realistic & practical
- 2= More interesting, lively & flexible learning
- 3= Greater opportunity to look, see and do
- 4= Easier to understand subject
- 5= Learnt new things
- 6= Better demonstration
- 7= Greater use of learning aids & computer technology
- 8= No difference
- 9= No response



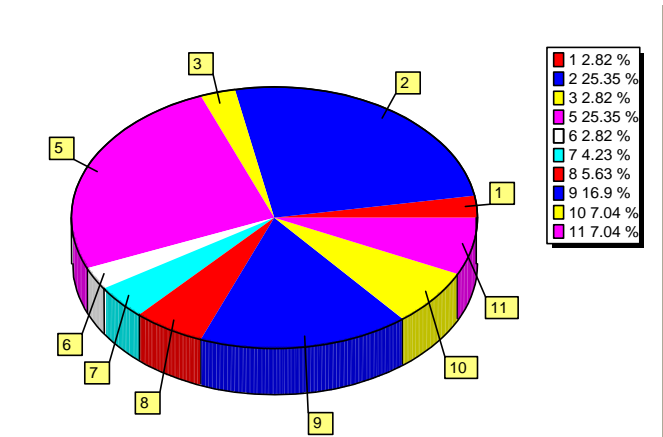
4a) Are there any parts in the learning units you still have difficulty with?

- 1= Difficulty with only one subject
- 2= Difficulty with only two subjects
- 3= Difficulty with three subjects
- 4= Difficulty with four subjects
- 5= Difficulty with five subjects
- 6= Difficulty with six subjects
- 7= Difficulty with seven subjects
- 8= Difficulty with all subjects
- 9= Difficulty with interface
- 10= Learning isn't hands on
- 11= Miscellaneous difficulties
- 12= No difficulty
- 13= No response



4b) What should be done or provided to make your learning easier?

- 1= Translate material into local languages
- 2= Provide better/more equipment & facilities
- 3= Provide more detailed learning materials
- 4= Adapt learning material to African setting
- 5= Use better teaching methods
- 6= Continue learning
- 7= More practice
- 8= Attend more lessons & seminars
- 9= No response
- 10= Nothing
- 11= Use VR in Schools



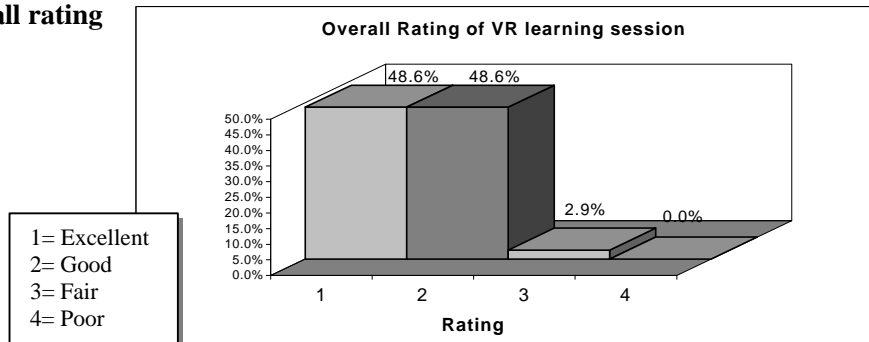
Section C: About the VR Lesson

1. To what extent do you agree with the descriptions of the VR lesson?

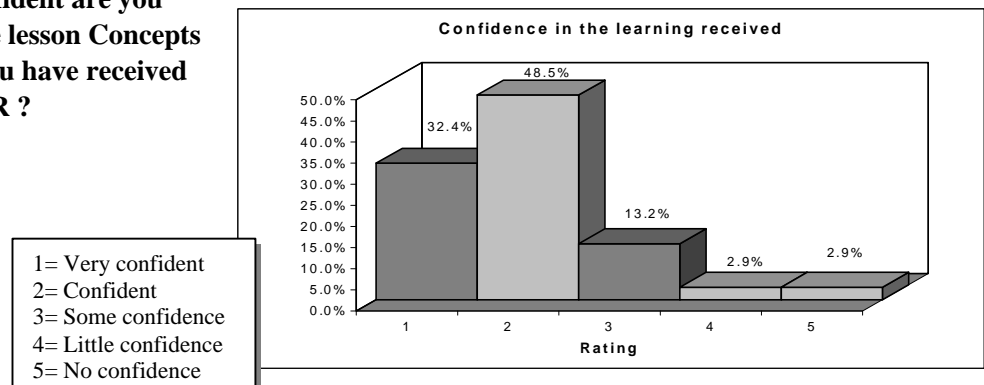
Questions	# of Responses	Mean	St. Dev.	Median
C1.1 - The computer visuals make the learning easier	142	1.4	0.6	1
C1.2 - I understand better with the computer visuals	142	1.9	0.8	2
C1.3 - I understand better without the computer visuals	142	3.7	1.2	4
C1.4 - It is the teacher's explanation which makes me understand	138	2.3	1.0	2
C1.5 - The computer visuals make the learning more enjoyable	140	1.3	0.7	1
C1.6 - The computer visuals complicate the learning process	136	3.5	1.4	4
C1.7 - The computer visuals help me to remember what I have learnt	142	1.8	0.8	2
C1.8 - The VR session cannot help me revise the topic	142	4.0	1.1	4
C1.9 - This VR session fits well with the rest of my lessons	138	1.9	0.9	2
C1.10 - Given the opportunity, I would like to have another VR lesson	142	1.4	0.9	1

Rating: 1= Strongly agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly disagree

2. What is your overall rating of this VR lesson?



3. How confident are you about the lesson Concepts / skills you have received in this VR ?



Section D: About Yourself (Demographics)

What is your age?

Below 10	1.43%
2=11 to 14	15.71%
3=15 to 19	82.86%
4=20 to 24	0%
5= above 25	0%

What is your sex?

Female	56.52%
Male	43.48%

What is the location of your school?

Rural Community	14.93%
Township	74.63%
City	10.45%

ANNEX 5 - Evaluation Methodology for assessing the usefulness visually interactive training materials in different African Learning Contexts.

1. Aims of the Evaluation

The aim of this evaluation is to assess the usefulness of using visually interactive training materials at the secondary and vocational levels of learning. The investigation will try to achieve this by mapping out the *perceived value* and *initial impact* of Virtual reality (VR) on student learning in different African learning contexts. The approach used will be illuminative in nature, seeking to examine and explore the process of using VR in selected schools and multi-purpose centers in Uganda and South Africa.

The focus of the evaluation is to try to establish whether using the visually interactive interventions can potentially have a positive impact on student learning. The study will focus on the following questions:

- Does VR affect the understanding of the topic being taught?
- Does use of VR affect learning retention?
- Does use of VR influence motivation towards learning?
- Is there any evidence of the application of the knowledge learnt after using VR?

N.B. There is no restriction on how each teacher uses the VR program to facilitate learning. It is however, important to document the conditions, the different teaching and assessment methods used in order to find out how the material works when it is embedded into a variety of learning contexts.

2. Method

The evaluation will consist of two main instruments

- a student questionnaire
- a teacher questionnaire

Where possible, follow-up interviews can be conducted to find more about the teachers' experiences of using VR, difficulties encountered and their issues of concern.

2.1 Selection of sample

The participating schools and Multi-Purpose Community Centres participating in the study have been selected based on the following:

- Access to computer hardware and software
- Availability of skilled teachers and facilitators
- Good infrastructure (electricity, road access, stone building, security)

2.2 Tools

2.2.1 Hardware

Each school or multi-purpose centre will be equipped with the following minimum hardware facilities:

Pentium III (or equivalent); 128 MB RAM; CD-ROM; 32 MB AGP Graphics Card (Riva TNT 2 or higher); Windows 98

2.2.2 Course Materials

The VR software will be downloaded on to the computer machines in the schools or multi-purpose centre and pre-tested to ensure that they are functioning properly. The survey will cover six learning units, namely:

Name of learning unit	Possible learning area	Brief description
Sand Filter	Science	Gadget used to demonstrate the process of filtering sand
Plastic Moulding	Science/Entrepreneurship	Demonstration of the plastic moulding process
Gun	Science/Life skills	How to operate and handle a gun
Lalibela	History/Culture	Learning about a heritage site in Ethiopia
Levers	Science	Introducing first, second and third lever types
French	Language	Using VR to practice learning a foreign language
Steam locomotive	Mechanics	VR model showing how a steam engine works, allowing the student to drag and connect the parts

2.2.3 Instructions

Facilitators will be briefly introduced to the software and how to operate it, who will undertake the VR demonstrations in the manner most appropriate for the audience.

2.3 Data Collection Instruments

Student Questionnaire

The student questionnaire includes a pre- VR questionnaire to be administered before students receive the VR training. The purpose of conducting a pre-questionnaire will be to determine students' preconceptions about the potential usefulness of VR as a learning tool, to find out the about prior experiences of using computer-based visual learning materials, and to elicit information they already have about the topic/lesson being presented. A post-VR questionnaire will be administered at the end of the course, after the pre-VR questionnaire. The questions are designed to establish the extent to which the students find VR to be a useful tool for supporting their learning, to assess their level of understanding of each R topic and to indicate difficulties and suggestions for later use.

Teacher Questionnaire

The teachers' questionnaires are designed to find out about their experiences of using VR, difficulties encountered and issues of concern to them. It will include questions about how exactly they used VR in their lessons, some indications of learner performance, and possible suggestions of integrating VR material in existing courses in each learning context.

ANNEX 6 - Student Questionnaire: Pre/Post Intervention

Date:	
Evaluator/Teacher:	
Learning Unit	
Student :	
Time :	

Description:

The student questionnaire includes a pre- VR questionnaire for determining your preconceptions as a student about the potential usefulness of VR as a learning tool, to find out about prior experiences of using computer-based visual learning materials, and to elicit information you already have about the topic/lesson being presented. The questions in the post-VR questionnaire are designed to establish the extent to which students find VR to be a useful tool for supporting their learning, to assess their level of understanding of each VR topic, to assess their level of understanding of each VR topic and to indicate difficulties and suggestions for later use.

The questionnaire consists of 4 sections:

- Section A: Pre-VR questions.
- Section B: Post-VR questions
- Section C: About the VR lesson
- Section D: Some attribute questions

SECTION A: Pre- VR session questions

Students should complete this section before the VR lesson

1. How confident are you about YOUR understanding on each of these topics?
(Circle the number of your choice for each topic.)

	Sand filters	Plastic Moulding	Guns	Lalibela	Levers	French language	Steam Loco	Rural Hygiene
very confident	1	1	1	1	1	1	1	1
confident	2	2	2	2	2	2	2	2
some confidence	3	3	3	3	3	3	3	3
little confidence	4	4	4	4	4	4	4	4
no confidence	5	5	5	5	5	5	5	5

2. a) Are there any parts of the topics/lesson you have difficulty with?

 b) How do you hope that this session will help you?

3. a) Have you had any experience using computer-based visual learning materials before? *(Circle the number of your choice)*

- 1 Yes
- 2 No

If the answer is yes,

- b) What was your level of participation? *(Circle the number of your choice)*

- 1 Minimal, the teacher was the only one using the computer
- 2 Average, the teacher occasionally allowed us (the students) to use the computer with guidance
- 3 High, students were allowed to operate the computers independently

- c) How would you rate your experience? *(Circle the number of your choice)*

- 1 Extremely enjoyable
- 2 Satisfactory
- 3 Not enjoyable at all

Please answer the rest of the questions after the VR session.

SECTION B: Post - VR session questions

Students should complete this section after the VR lesson

How confident are you now about each of the following topics

	Sand filter	Plastic Moulder	Gun	Lalibela	Lever	French	Steam Locomotive	Rural Hygiene
Very confident	1	1	1	1	1	1	1	1
Confident	2	2	2	2	2	2	2	2
some confidence	3	3	3	3	3	3	3	3
little confidence	4	4	4	4	4	4	4	4
no confidence	5	5	5	5	5	5	5	5

1. In your own words, write down what you think was the most important thing you learnt about each of the 7 topics.
.....
2. a) Did this VR lesson help you in the way you had expected? (*Elaborate briefly*)
.....
3. How was this VR lesson different from your normal lessons?
.....
4. Are there any parts in the learning units you still have difficulty with? If so,
 - a) Indicate what area (s)
.....
 - b) What, in your opinion should be done or provided to make your learning easier?
.....

SECTION C: About the VR lesson

1. To what extent do you agree with the descriptions of the VR lesson?
(1-Strongly agree, 2-Agree, 3-Neutral, 4-Disagree, 5-Strongly disagree)

The computer visuals make the learning easier					
I understand better with the computer visuals					
I understand better without the computer visuals					
It is the teacher’s explanation which makes me understand					
The computer visuals make the learning more enjoyable					
The computer visuals complicate the learning process					
The computer visuals help me to remember what I have learnt					
This VR session cannot help me revise the topic					
This VR session fits well with the rest of my lessons					
Given the opportunity, I would like to have another VR lesson					

Please add any other comments that you wish:

.....

2. What is your overall rating of this VR lesson?
- 1 Excellent
 - 2 Good
 - 3 Fair
 - 4 Poor
3. How confident are you about the lesson concepts /skills you have received in this VR lesson?
- 1 very confident
 - 2 confident
 - 3 some confidence
 - 4 little confidence
 - 5 no confidence

6 SECTION D: About yourself

1. What is your age?
- 1 below 10
 - 2 11 - 14
 - 3 15 – 19
 - 4 20 – 24
 - 5 above 25
2. What is your sex?
- 1 Female
 - 2 Male
3. What is the location of your school or multi-purpose centre?
- 1 Rural Community or village
 - 2 Town /Township
 - 3 City

Thank you for your time and effort in completing this questionnaire.

ANNEX 7 - Teacher Questionnaire

Date:	
Evaluator/Teacher:	
Learning Unit	
Time :	

The teachers' questionnaire is designed to find out about the actual experiences of using VR, difficulties encountered and issues of concern. It includes questions about how exactly VR is used in the lessons, some indications of learner performance, possible suggestions of integrating VR material in existing courses, and issues dealing with indications of the cost of delivery in each learning context. The way students are introduced to a program, the preparation that goes into the teaching and providing support to the learners, the final assessment etc, are all crucial for the perceived and actual value of using VR. The teacher /facilitator should provide any vital information she/he believes is critical for teaching and learning with VR.

To the teacher / facilitator:

Please formulate 2-3 questions to assess student understanding of each topic/unit.

The questionnaire consists of 4 sections:

Section A: Rating of VR software. This section should be completed before Preparing the lessons for the students. *(Adapted from LTDI : Implementation of learning Technology)*

Section B: About the VR lesson

Section C: Teacher's experience of using VR

Section D: Teacher assessment of student work

SECTION A: Rating of VR software.

How would you rate the VR software package in terms of: *(circle appropriate number)*

1. Usability										
<i>Excellent</i>										<i>poor</i>
10	9	8	7	6	5	4	3	2	1	

2. Layout										
<i>Excellent</i>										<i>poor</i>
10	9	8	7	6	5	4	3	2	1	

3. Academic Content										
<i>Excellent</i>										<i>poor</i>
10	9	8	7	6	5	4	3	2	1	

4. Attainment of Learning Objectives										
<i>Excellent</i>										<i>poor</i>
10	9	8	7	6	5	4	3	2	1	

5. What kind of additional support would be required for a student to work through the package by themselves?
.....

6. Could this VR software be used as part of your courses/lessons?

1 Yes
2 No

a) If so, - HOW?
.....

b) If not, - WHY NOT?
.....

7. Is this a good way of teaching this topic? Provide reasons for your answer.
.....

SECTION B: About the VR lesson

1. To what extent do you agree with the descriptions of the VR lesson?

(1-Strongly agree, 2-Agree, 3-Neutral, 4-Disagree, 5-Strongly disagree)

The preparation for this VR lesson was easy					
I feel confident using this method to teach					
My students enjoyed the VR lesson					
The material was challenging for my students					
The teaching time using VR was less than for my normal lessons					
VR can be useful for learners with difficulties in the topics					
It is easy to integrate the VR lesson into my course					
This VR lesson can help with revision of the topics					
This software can be used in more than one course					
I would like to use VR more often					
VR lessons are too expensive					

Please add any other comments that you wish:

.....

2. Comment on your experience of teaching with VR.

.....

3. What was good about it?

.....

4. What was bad about it?

5. How can it be improved?

.....

SECTION D: Teacher assessment of student work

Kindly provide a brief report of:

- a) how you assessed the student learning for each topic (please include a sample of the questions that were asked)
- b) student performance

SECTION E: Your attributes (*Circle number of your answer*)

1. What is your age?
 - 1 20 – 24
 - 2 25 - 34
 - 3 35 - 44
 - 4 45 - 54
 - 5 above 55

2. What is your sex?
 - 1 Female
 - 2 Male

3. How many years of teaching experience do you have?.....

4. What VR training do you have?
 - 1 extensive
 - 2 adequate
 - 3 very little
 - 4 none

Thank you for your time and effort in completing this questionnaire.
