Chris M. Byrne

Virtual Reality and Education

Virtual Reality (VR), a new computer technology, has incredible potential in the education field. The reason for this assertion is that education is a field that requires the students to understand complex data, particularly in the study of science (see "Why is science hard to learn?" by Millar) and VR makes that task easier. VI presents information in a 3-dimensional form with the participant viewing the world from inside the world (an immersed viewpoint) with the ability to interact with the information or world. People can enter a VR world that is already created or build their own. VR' style of presentation mimics the ways that we, as humans, have learned to interact with our physical world. The requirement of learning abstract concepts (such as written language or jargon of a particular field) in order to understand data is dramatically reduce For example, a chemistry world can show participants how electrons hover around a nucleus depending on the amount of energy involved. The abstractness of the subject would not be eliminated, but metaphors could be employed that were based solidly in reality. For instance, in the electron world the color of the world could represent the amount of energy in the system with red representing more energy than blue. For the students, they would be able to relate to hot things looking red and cold things looking blue witho the concept of "joules increasing" getting in the way.

This VR way of presenting information is compatible with the literature in education about differing learning styles. The literature on learning styles overwhelming asserts that different people take in information differently. The metaphor of right and left brain thinking is used to describe some different ways that people think and take in information.

"Meanings for the right hemisphere dominant learner, however, are much more self-centered. They are more concrete, tied to visual and tactile symbols. Meanings for words are not abstract from personal context. They have meanings specific to certain contexts. While left hemisphere dominant learners can use words with precision to communicate meaning, right hemisphere dominant learners have difficulty because meaning is embedded in their holistic experience. Conveying specific meaning through language requires a separation from immediate personal experience in order to attach verbal symbols to that experience. The right hemisphere dominant learner, then, will have difficulty using language to express explicit meaning. The left hemisphere dominant learner attaches language to meaning in order to store them in memory. The right hemisphere learner probably stores meanings in pictures, impressions, without attaching verbal labels to them." (Browne, p. 29)

The literature also suggests that information should be presented in the style that best matches the student's style, but that the other styles should also be represented. This allows students to understand the material while expanding their way of thinking to include other processes. They potentially can relate their natural style with another style. For example, they can see a film with text and relate the style they know to the foreign modality.

Of interest to teachers is the question of whether teaching styles need to be matched to learning styles in order to ensure positive instructional outcomes. Henson and Borthwick (1984) cite studies that show significant increases in academic achievement and more positive attitudes toward learning when students were taught in relation to their learning styles." (Emihovich and Miller, p. 474)

Any instructional approach should offer a learning environment which will encourage children to develop the processing of both hemispheres. They should be given an opportunity to apply their preferred hemisphere whenever possible to learning new skills. However, they should also be exposed to activities which encourage the use of both hemispheres in situations where they are not penalized for failure, to provide opportunity for the weaker processes to develop" (Browne, p. 31)

A literature search of learning styles and computers results in articles advocating computer usage as a positive method of matching learning styles to the students if used correctly. Basically, the articles are saying that the characteristics of computers are conducive to a wide range of learning styles, but there is no guarantee that how the computers are actually programmed will actually be beneficial to many different people. For example, while computers can be programmed to have cool graphics and interesting interactivity, often the only programs in use are of the drill and practice mode which tends to not excite or motivate "right-brained" thinker. Actually having students program the computers themselves is seen as a beneficial method of using computers.

"From good computer-based instruction, these children have been able to enter new worlds through images on the screen and to learn from these experiences. This information is presented to children on the screen in interesting, colorful, and challenging formats that allow active participation while it reflects their work pace and adjusts to their skill levels." (Lee, p.87)

"Computer programming offers opportunity for virtually unlimited creative expression. The user can think about a real-life experience and produce it as an abstract entity for the computer. Thus, two processes (remembering and interpreting) that are prerequisites to the valued abstract higher levels of thinking are fostered by computer use." (Lee, p. 84)

Seymour Papert has been a main advocate of using computers in a particular way to enhance learning. He developed a language known as Logo which is based on the concept of syntonic learning.

For learning to be syntonic, it must satisfy three criteria: (1) continuity - "mathematics, for example, must be continuous with well-established personal knowledge from which it can inherit a sense of warmth and values as well as cognitive competence"; (2) power - "it must empower the learner to perform personally meaningful tasks which could not be done without it"; and (3) cultural resonance - "the topic must make sense in terms of a larger social context" (Papert, p. 54)

In light of these assertions about learning styles in general and th proper use of computers, in particular, VR fares quite well. VR offers everything that good computer programs do, plus more. Well-made VR worlds engage more of the student's senses and inherently appeal to different learning styles. Control of one's environment a interactivity are corner stones in VR. Currently, the graphics in V are not as vivid as is possible on a computer screen, but are still quite engaging. If the method of having students create their own world is used, the gains that Lee and Papert refer to can be achieve

In light of these claims that VR would be useful in education, two pilot studies were conducted by the Human Interface Technology Laboratory (HITLab) at the University of Washington in collaboration with the Pacific Science Center to explore VR as a learning tool for young people. The purpose of the first study was to ascertain whether any student in the age range of 10 to 15 could creatively work with the technology of VR and whether they would enjoy it. In the summer of 1991, a summer camp was run where the students created virtual worlds on the computer and then went into them (see Bricken and Byrne, 1991). This camp was very popular with the participants and the students created interesting, intricate virtual worlds.

The second study was in the summer of 1992, when the HITLab and the Pacific Science Center, under the auspices of the Creative Technology Camp, collaborated for the second summer in a row. The

purpose of this study was to extend our knowledge about children and Virtual Reality. We decided on two directions of exploration. The first was an attempt to mimic the use of VR in a curriculum. The second was to diversify our student population in order to generalize more about learning styles and VR.

The structure of the study was seven sessions of a week long day camp, held from July through August, where children ages 10 to 16 learned about science through "hands on" experience. Not only did the students explore VR, but they were also exposed to robotics, computer animation, laser discs, and electronic music.
The preliminary involvement with VR for the students consisted of everyone in the camp watching videos and listening to members of the HITLab. The students would then practice creating 3-D graphical objects on a Macintosh with the software package, Swivel 3D™ Professional for 50 minutes on Monday and Tuesday. On Wednesday, about 10 students out of the 25 or so in the camp (due to resource constraints), could choose Virtual Reality as their focus. Their participation entailed brainstorming as a group in deciding what world they wanted to create. After that process was complete, they would work in teams of 2 or 3 and create objects in Swivel 3D™ that fit the theme of their world. By Thursday afternoon, the group would be done with their world and members of the HITLab would export the world into VR. On Friday morning, the world builders would visit the HITLab and enter their world in VR.

The issue of trying to explore VR in a curriculum relates to our vision of the use of VR in education and the literature on learning styles. While we see that the creative process involved in world building in VR is a learning experience in itself and lots of fun, boundless formation of worlds is not the only use for VR in the learning process. Theoretically, VR can be used in conjunction with many class subjects and appeal to different learning styles. Subjects that rely on visualization, such as science and social studies, could benefit from the use of VR. The traditional method of text based instruction could be augmented by the experiential method of VR. Furthermore, the way VR could be used in classrooms could be varied. On one end of a continuum is the learning that occurs from building a world. For the student/creator, it is a synthesis of knowledge about the subject and allows the creator and others to reflect on that information when they explore the world in VR, while being an empowering creative process. On the other end of the continuum, the students enter a pre-fabricated world (the

mobile home end of the continuum) where they learn from the exploration and not the creation of the world. Of course, any compromise between these two extremes is possible. Maybe a student would build part of a world or add on to an existing world i order to facilitate learning. The point is that we feel strongly th VR can be used as an effective tool within a classroom setting.

We faced the issue of tying VR to a particular subject within the structure of a short summer camp. We discussed teaching a history lesson, ecology lesson or biology lesson, among many other ideas, but realized that the tyranny of time made teaching any particular subject impractical. We decided to mimic the constraints that would be placed on world building in a classroom by placing constraints that did not need to be taught. Instead of teaching rul of an ecological system or the ways that Mayans actually built pyramids and asking students to build their worlds within these realities, we asked the students to build their worlds with an emotional theme. We concluded that while this was not the same as following a lesson plan, some of the elements remained. The students were being asked to build a world with external constraints. We were asking them to take an abstract concept and incorporate it in VR. The abstract concept had some semblance of a shared cultural meaning but allowed for differing views to emerge.

Unfortunately, the emotional theme constraint was not very successful in the way we intended. The students did choose an emotional theme each week in addition to a more tangible concept for their world, but spent very little energy in incorporating the emotional theme in their world. Instead, they focused on the tangible part. For example, "Peaceful Rain Forest" world has many trees and nothing overtly violent, but "peaceful" is not an obvious trait of the world. They focused on the rain forest. In hindsight, concluded that designing a world with emotional content is too abstract of a concept, at least at this age level. The surprising aspect of this exercise was the emotions that were collectively agreed upon. Before the camp started, some staff members were apprehensive about the range of emotional themes that would be desired by the students. It was thought that this age level would overwhelmingly be drawn to violent, competitive themes. Instead, we consistently heard peaceful, funny, happy themes suggested. We have nothing to officially conclude about that, other than it was a lot of fun to watch the group dynamics.

The other new direction for the 1992 summer camp was to pursue diversity of the student population. The first summer camp consisted of a population reflective of a college of engineering, on: younger. White males were highly represented. We did not do a formal survey of background during the first summer camp, but personal observation and the cost of the camp (around $400 for a week long technology summer camp) lead us to believe that we were interacting with a largely computer literate population. These were kids who for whatever reasons were attending a computer camp instead of a horse or soccer camp. Given that computers are typically taught and geared for a traditional style of learners, we concluded that we were dealing with a narrow range of learning styles. While there is nothing wrong with this population learning about VR, it did pose two problems for us as researchers. First of all, our data was not very generalizable. We were not working with an average population of children. We learned that highly motivated kids who loved computers also loved VR. This was necessary to know as a first step, but we needed to move beyond that. Secondly, we have theorized that VR not only would be accessible to students who did not typically like computers i.e., students with different learning styles, but that VR would be a motivating factor for them. Eventually, we hope to prove that VR helps the non-traditional computer user even more than the traditional one.

To continue our studies for this second study, we needed to work with a more diverse population. We were very successful in this regard. US West donated $10,000 for scholarships for 20 students who would not be able to attend the camp otherwise with the goal of improving the racial and gender balance. The total number of children who attended the camp, including scholarship students was 69 (see appendix A for breakdown of the population by race, gender, age, and scholarship).

Our research objective was to see, through surveys and personal observation, if there were noticeable differences in the way children liked or interacted with VR that followed gender or race or scholarship categories. We used these categories because the literature suggests that learning style differences might follow race or gender lines.

"It is well documented that American public schools value the analytical learning styles, which emphasize spoken and written language as used by the middle class and emphasize content reflective of the lifestyles of white Protestants.

Black children, on the other hand, usually are proficient in the relational learning styles, which emphasize visual and audio simuli. Webb points out that relational learners fail in school far more often than analytical learners do. Our schools are focused away from large segments of students; this omission is unrecognized for its relationship to school failure and, thus, not addressed in plans for school improvement or increase in achievement." (Lee, p.81)

Overall, while we found that there were some discernible differences in the students' self reported feelings about their experience with VR at the HITLab that could be attributed to race and scholarship groupings, most everyone had a highly enjoyable time in VR. From personal observation, we noticed distinct differences in the way groups of students interacted with the computer while building the world. Both of these conclusions are quite encouraging. From the literature we would expect a difference in computer usage for groups of students with different learning styles, so our observations verified for us that we were indeed dealing with different populations who have distinct relationships with computers. Furthermore, while we cannot expect absolutely everyone to like VR, most differences did not appear in VR, which points to the idea that performance differences, or at least changes in enjoyment levels, among groups of people are lessened in VR. To elaborate, first I will focus on the boundaries that VR can break through and then I will concentrate on the differences in self reported feelings about VR and the camp.

A couple of anecdotal examples can illustrate the power of VR more clearly. The first example is from the first week of the summer camp. For that week, I provided transportation for the scholarship students since otherwise they would not have been able to attend. On the first day, I arrived at the home of one of the students with the idea of driving 4 students to the camp. Instead, there were 5 people (3 girls and 2 boys) waiting to attend. Since I could only bring 4 kids, the one girl who did not have her forms filled out was chosen as the one who was not able to go. By the end of the day, which consisted of rotating through the different technologies, the 4 students who had been able to attend were probably envious of the girl who had been excluded. They all seemed to have a miserable time. During much of the day, they looked bored and uninterested in the technical topics. One of the boys slept with his head on the des for a large portion of the day.

We had various theories as to why they behaved this way. It could have been that they are simply unmotivated, poor students.

However, a more likely reason is that they were suffering from culture shock. Without really knowing what they were getting into, we thrust them into a very unfamiliar setting. They had very little background with computers. They were not sure when to "click" or "double click" the mouse, while many non-scholarship kids were bypassing the mouse completely and using the option keys. The style of learning required of them was primarily sitting still and listeni to lectures, which may have not been their main mode of learning. Additionally, the scholarship students were all African-American while of the other 20 some campers, only one was African-American. None of the 10 or so instructors were African-American. Overall, there were many reasons why the scholarship students that week might have felt uncomfortable in the situation and reacted by withdrawing.

We survived the first day, but when I went to pick up the students o Tuesday morning, the two boys were missing and the two girls were not ready to go. However, the one girl who had been left behind the day before was there, lunch and forms in hand. I waited for the other two girls and then we all attended the camp. This day was no better. The new girl had her head on the desk most of the day and the other girls looked very bored. I felt that if we did not interv somehow, there would be nobody to pick up the following day. So, instead of struggling through the rest of the day, I left early with the girls and brought them to the HITLab. I put them into every virtual world we had and let them explore all they wanted. Their reaction was strongly positive. I realized that they had not understood how the work on the computer back at the camp related to Virtual Reality. With an overview of the technology and experiential use of it, they were much more motivated to continue with the camp.

The next day, all of the girls and one of the boys were ready and waiting when I arrived to pick them up. They all created something on the computer which was subsequently placed in VR. Their objects were not necessarily as elaborate as those of the students who had more experience with computers, but the objects were definitely a source of pride. Actually, differences in object complexity among the students throughout the course of the camp were dampened by choosing more intricate dynamics for the simpler object within VR (e.g., color change or movement). This had a practical side to it, since it is easier to give dynamics to less complicated configurations.

The most exciting part of the process that week for us as researchers was to see all of the students experiencing VR. The scholarship students reported more difficulty in moving around the world, but everyone said that they wanted to come back and try VR again. They all talked about how much fun it was. Clearly, VR was a motivating force for all the kids. We had expected to see that students who loved computers would also love the next step in computer technology, but we had not been sure of what to expect from students who had expressed little interest in technology. We have a few theories as to why the kids enjoyed VR. The most obvious reasons are that VR is new and different and it enables people to do things that they cannot do in the physical world, such a fly and go to places that do not exist. Furthermore, for people who get to build their own world, the creation process is a big draw. These reasons were substantiated by the students' answers when we asked them what they liked best about VR ("I liked being in control of my actions and experiencing the result of our designing for the world" "flying" "It was cool to be able to make a world and actuall go in it.").

A deeper, more transparent reason may exist as to why the kids, including those not typically engaged by computers, enjoyed VR. We theorize that due to the less symbolic requirement of VR, the frustration level with using this technology is reduced, thereby allowing the fun of the program through. Since symbols are highly related to the culture in which they are derived, people outside of that culture are at a disadvantage. In the VR world that the kids created, there were no esoteric metaphors to get in the way, and no highly coded commands to know. If people wanted to look behind them in VR, they merely turned around in the same way as they would in the physical world. Everyone has experience in the physical world and they can build on that knowledge in the VR world. The hurdle of "feeling stupid" is reduced.

Another anecdote concerns cultural differences as they relate to computers, VR and gender. First of all, the girls in the camp tended to make different types of objects than the boys. The girls seemed to enjoy more abstract shapes with lots of colors while the boys often concentrated on robots. Actually, the boys made more than just robots, but they did seem to like more concrete, complicated objects. Age also seemed to be a factor in the types of objects that

were made, with older kids choosing more realistic representations of physical objects.

A more interesting observation was made in one of the later weeks of the camp. For that particular week, out of the ten VR students, we had 2 girls on scholarship and the rest were non-scholarship boys. We realized that as instructors, we had judgments as to what was "correct" computer behavior. Of course, we had basic rules about no eating and drinking around the computer and no hitting each other at any time. But furthermore, we had expectations of students sitting at the computers quietly and being "on task." Part of this : a practical matter, since we had several people in one room working on lots of different projects and we needed to insure that the distractions were kept to a bare minimum. However, in the case of computers, I think that some of our expectations are merely reflections of the common usage of the technology by the dominant computer culture which is reflective of a certain style of learning. The example from this week is that the boys stayed on task and quietly worked on the computer. The girls also engaged with the computer, but it took a different form. Instead of sitting quietly, they chose to make up songs and dances while working on the computer. They would get up and spin around in between creating objects, giggling all the while. Granted, in a classroom setting, tl boys' behavior is easier to manage, but the point is that neither wa of dealing with the computer is "the correct" way of doing so. If females were involved with computers to the same degree that males are, we might have a different code to follow.

The wonderful thing about VR is that there is no set tradition on th proper way to behave in VR due merely to the newness of the technology. Moreover, from numerous observations of people in VR, when a code of behavior does start to form, it will probably encourage more movement, rather than remaining still. When people watch other people in VR, they are constantly extolling them to look and move around more. Of course, if individuals do choose to remain stationary, no one will berate them harshly. The point of this example is that while computers have a narrow range of proper behavior that may hinder certain groups of people or individuals, VR does not currently inhibit anyone's mode of interacting and probably will not in the future.

Overall, while we do feel that VR breaks thorough boundaries of race and gender we did find significant differences by race, gender, and scholarship for some of the questions we asked in our survey (see Appendix B for full list of questions with significant t-tests to an alpha of .05). Gender was significant in only the question that ask whether the student was aware of the physical surroundings while in the virtual world. We have no conclusion to draw at this time regarding that subject. Actually, for this question to be the only that is significant for gender is amazing. We asked questions about their enjoyment in building worlds and in going in VR, which were not significant by gender.

Race and scholarship categories were correlated at a .65 level, which was not surprising since the scholarships were aimed at underrepresented racial groups. The averages of the survey questions by race and by scholarship were very similar due to the correlation, so I will refer to them as a group. We found significa differences between race/scholarship for the questions which asked: how much did you enjoy designing and building a virtual world?; how much would you like to build another world?; and how much would you like to be in VR again? These questions are the major indicator of the students' enjoyment of VR, particularly since we also asked about the camp as a whole and found no significant difference by race/scholarship. This could be worrisome and possibly suggest that VR is not as positive for non-traditional computer students since their mean was lower than the non-scholarship, white students. However, the lowest mean for the scholarship students of color on any of those questions was 8.28 out of a possible 10. This indicates that although the scholarship students did not rank their VR experience as highly as the non-scholarship students, they still ranked it very high. We must also remember that the non-scholarship students were a group of people who actively wanted to go to a summer camp on technology. So, while there was a statistical significance to the difference in the means, the raw means of the various groups show an overall vote of approval for VR.

Now, before I convince everyone that VR is the answer to all of our educational problems, the downside of VR needs to be discussed. For VR in general, there are many ethical considerations that have been voiced, such as the issue of addiction to VR. While I think those issues are important to discuss, for the purpose of this paper I wil narrow the focus to the topics of: appropriate use of VR; and individual feelings about VR.

Appropriate use of VR relates to the issue of just because we have a certain technology, should we use it? From the experience of the summer camps, we have evidence that VR has a definite role to play in education, if merely from a motivational viewpoint. However, this should not be extrapolated to the idea that VR should be used for every aspect of education. While VR may offer something for every subject, the cost of the system, especially at current prices means VR is a heavy resource sink. VR should not be artificially forced into a subject when another method is available that teaches roughly as well for a lot less money. Not only is this a bad decisi from an economic standpoint, but it also a bad decision for VR. The message is sent that there are not enough real ways that VR can help education, so fake situations are fabricated. For example, a world i VR could convey a foreign country for a social studies class. However, a film can convey much of the same information with better resolution for a dramatically lower cost. To use VR in this case, is to not acknowledge the power of VR.

There are many subjects that VR can fill a void that cannot be currently covered. For example, subjects that rely heavily on visualization of abstract concepts are a prime topic for VR use. While the social studies example does rely on visualization, the country is a real place that can be captured visually by relatively cheap equipment. A subject such as chemistry or physics requires visualization, but of a more abstract kind. What does an electron o atom really look like? A student may get to visit a foreign country and interact with other people, but will never get to interact with an electron on a human level. VR lets students "see" the subject who learn best that way instead of just reading or hearing about. That i a non-trivial use of VR in education. VR should not be used in superfluous ways at this time. If the resource drain of VR diminishes greatly in the future, then maybe an argument could be made for a more ubiquitous role for VR.

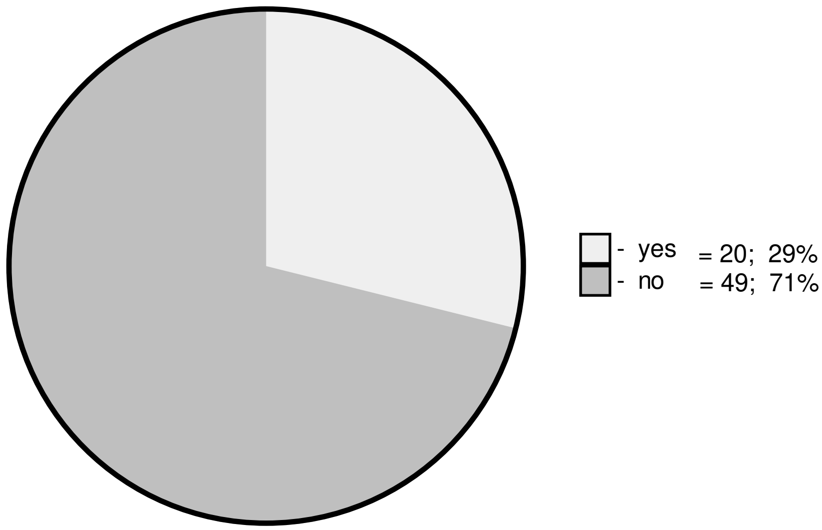
The other downside of VR is that not everyone likes it. A huge number of people do love it, but it is not unanimous. Of course, it rather unrealistic to think that anything in the world would have fu agreement and VR is no different. During the summer camp, we had almost 70 kids go through VR and one girl just did not like it. We asked everyone to rank their feelings about going into VR again on a scale of 1 to 10, where 1 is not at all and 10 is the equivalent of "yes, yes, yes, please let me go back in." The overall mean was 9.3 with a mode and median of 10. This particular girl answered with a

1. The next lowest score after hers was a 5. Maybe she would grow to like VR if she had more exposure. When questioned, she stated that she was scared to go into VR and would rather just build worlds on a computer. She was not able to articulate what aspects of VR frightened her. Interestingly, other students cited safety as their reason for liking VR. They felt safer in VR than in their real live: Whatever the viewpoint, individual differences need to be respected. For the one girl, at this time VR is not a good learning tool and to force her to use it may not be beneficial.

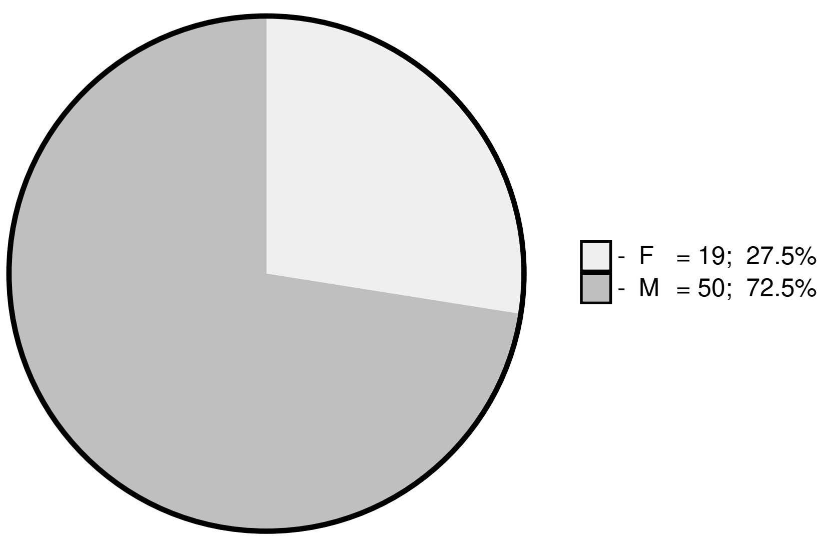
The future direction of studying VR and education should be a furthe: expansion of the student population and a closer relationship with a curriculum. Possible target populations could be '"at risk" student: students with learning disabilities, "normal" mainstream students, and "gifted" students. Currently the Human Interface Technology Lab is involved in an AIDS education world that "at risk" students are building themselves, after hearing lectures on AIDS awareness. In addition, we are involved with a chemistry curriculum at a mainstream high school, where students will enter a pre-fabricated world of electron clouds. We have discovered in our 2 pilot studies that the children who were involved in VR in the camp had a highly enjoyable experience that crossed race and gender boundaries for the most part. We are confident that our results will generalize to a larger population of students and that VR will be quite useful as an educational tool.

Appendix A
Scholarship, Gender, and Race Totals

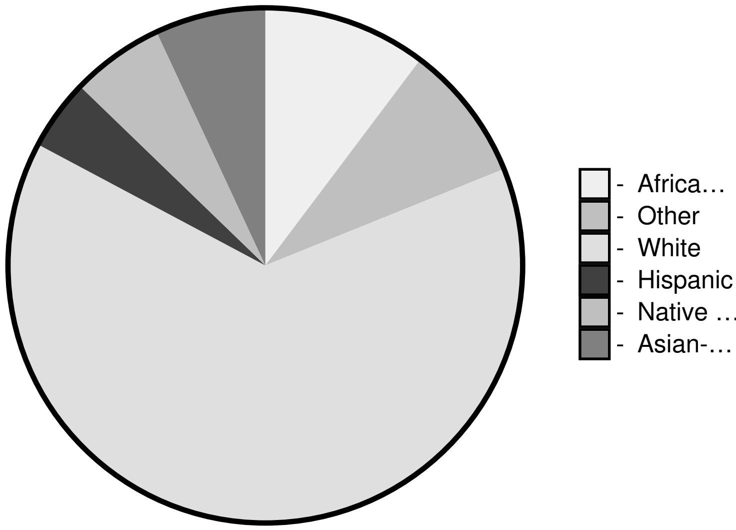
Pie Chart of scholarships



Pie Chart of gender



Pie Chart of ethnicity



ethnicity

Bar:	Element:	Count:	Percent:
1	African-American	7	10.1
2	Other	6	8.7
3	White	44	63.8
4	Hispanic	3	4.3
5	Native American	4	5.8
6	Asian-American	5	7.2

Race

Bar:	Element:	Count:	Percent:
1	White	44	63.8
2	Of Color	25	36.2

Appendix B
Questions with Significant t-tests

Gender

DF:	Unpaired t Value:	Prob. (2-tail):
65	-2.312	.024

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
F	19	6.421	3.097	.71
M	48	8	2.26	.326

How much were you aware of the physical world while you were in the virtual world?

1 - very much 10 - very little

Race

DF:	Unpaired t Value:	Prob. (2-tail):
67	2.071	.0422

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
White	44	8.932	1.246	.188
Of Color	25	8.28	1.275	.255

How much did you enjoy designing and building a virtual world?

1 - Not at All 10 - Very Much

Race

DF:	Unpaired t Value:	Prob. (2-tail):
67	3.459	.0009

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
White	44	9.682	.771	.116
Of Color	25	8.44	2.162	.432

How much would you like to build another world?

1 - A Little 10 - Very Much

Race

DF:	Unpaired t Value:	Prob. (2-tail):
52	2.151	.0361

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
White	33	9.727	.761	.133
Of Color	21	8.762	2.406	.525

How much would you like to be in VR again?
1 - Very Little 10 - Very Much

Race

DF:	Unpaired t Value:	Prob. (2-tail):
51	.607	.5464

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
White	33	9.333	1.19	.207
Of Color	20	9.15	.813	.182

How much did you enjoy the PSC Technology Camp?
1 - Very Little 10 - Very Much
(Not a significant t-test)

Scholarship

DF:	Unpaired t Value:	Prob. (2-tail):
67	-2.094	.04

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
scholarship	20	8.2	1.24	.277
not scholarship	49	8.898	1.262	.18

How much did you enjoy designing and building a virtual world?
1 - Not at All 10 - Very Much

Scholarship

DF:	Unpaired t Value:	Prob. (2-tail):
67	-4.63	.0001

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
scholarship	20	8.05	2.305	.515
not scholarship	49	9.714	.677	.097

How much would you like to build another world?
1 - A Little 10 - Very Much

Scholarship

DF:	Unpaired t Value:	Prob. (2-tail):
52	-3.239	.0021

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
scholarship	16	8.312	2.626	.656
not scholarship	38	9.789	.704	.114

How much would you like to be in VR again?
1 - Very Little 10 - Very Much

Scholarship

DF:	Unpaired t Value:	Prob. (2-tail):
51	.296	.7683

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
scholarship	15	9.333	.816	.211
not scholarship	38	9.237	1.149	.186

How much did you enjoy the PSC Technology Camp?
1 - Very Little 10 - Very Much

(Not a significant t-test)

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