RIT/NTID

An International Symposium
Technology and Deaf Education

"Mocap ASL in the Sciences:
Results and Future"

Presenters:

Scott Whitney

Session W10E
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>> Hello, everyone. Good morning. My name is John Reid.
I'm here to introduce the presenter of this presentation. I
want to introduce Scott Whitney. He's the assistant
professor at -- oh! It changed! It changed!
>> I was promoted to associate.
>> Associate professor of deaf education program at the
State University in Texas. The topic of the presentation is
Mocap ASL in the Sciences: Results and Future.
Before you leave, if you would fill out the evaluation.
Today's presentation will last about 30 minutes, and then
we'll have ten minutes questioning. We need the remaining
of the hour to prepare to the next presenter. Okay? All
right.
>>SCOTT WHITNEY: Good morning. First, I'm just wondering,
how many of you are from RIT? Four. Okay. I've got a
short quiz, and you might know the answers, because I took
it from Dr. Lange's book.
First, I need to let you know, my research was supported by
the National Science Foundation. And previously, I forgot
to put that down, and they were a little upset with me, so I
make sure I incorporate that.
I'm really sorry that I don't have handouts for you this
morning. I was on vacation last week. I was at home
working furiously trying to get this finalized, and I was
never quite satisfied with the results, so I kept making
revisions. Feel free to E-mail me and I will E-mail you a
copy of my overheads. The supporting materials.
The presentation this morning is going to cover the need for
science resources for deaf educators, how I developed
additional resources, and future directions.
What I focused on was technology. We're not really --
technology wasn't really ready for a comprehensive use of
Motion Capture. Now, I focused on science vocabulary
because I really love science, and later in the
presentation, I'll explain motion capture and how it works.
Let me start off with a quick quiz. Now, folks from RIT,
don't divulge the answers, let other people have a chance
first.
Can anybody name two deaf Nobel Prize winners? Folks from
RIT know their names? Oh, you did know, but you forgot.
Okay. I'm going to let Mr. Lange know that the audience
this morning failed to come up with the names.
Now, it was interesting developing research on steroids.
You can see on the overhead, and studying cholesterol, and
the second prize winner discovered the vector for Typhus.
Now, can anyone name three deaf people who were nominated
for a Nobel Prize?
Yes, there were two women.
>> I couldn't remember who they were.
>>SCOTT WHITNEY: Yes. She said there were two deaf women.

The first one wasn't awarded the prize because she passed
away before they had an opportunity. They didn't award it.
>>AUDIENCE MEMBER: I think it was chemistry.
>>SCOTT WHITNEY: And there was another male.
>>AUDIENCE MEMBER: I think the second one -- oh, darn, I
can't think of what it is! Anne. Right. Right. It had to
do with astronomy. I knew it was astronomy.
>>SCOTT WHITNEY: Annie Jump-Cannon developed a huge catalog
of the stars. And these two worked collaboratively, and I
remember one of them passed away and they were not awarded
the prize.
And finally, Oliver Heaviside was awarded the prize in
calculus.
So, the point of bringing this up is that deaf and hard of
hearing people can learn in silence as well as anyone -- can
learn science as well as anyone, but right now, the research
doesn't seem to show that. Often deaf people lag behind,
despite that capability. And most of the scientists in
Dr. Lange's book were either born deaf or became deaf very
early in life.
So being pre lingually deaf doesn't doom children to
failure. Most teachers often don't know these answers. In
fact, they can't name any deaf scientists.
And that could be frustrating. Now, the vocabulary used in
science, often the teachers aren't aware of how to teach
deaf children the technical vocabulary. But what we hope
is -- well, if you see this old Proverb, where there's no
vision, people parish. And a second adage is no dreamer is
ever too small, no dream is ever too big.
Small incremental change can have a very large impact.
I mean, just doing simple math, 2.5% annual growth in
reading levels for children as they graduate from high
school would increase their grade level from 4.5% to 5.7%.
And that much increase in grade level of reading ability.
So those small incremental changes can change the world.
You're all family with NCLB, the No Child Left Behind Act?
When that law was passed, it really had an impact on deaf
education. What -- how did that affect us? What's the
meaning? The importance of NCLB for deaf education?
>>AUDIENCE MEMBER: It meant that all children would be
educated equally, everybody would have equal access on a
parallel track and they would all get the same information
that their peers were getting, in the same sort of setting,
and their expectations would be similar as well.
>>SCOTT WHITNEY: Okay. Folks here who are teachers, who
teach with elementary children, will be required to give
them the same tests. Before, they didn't have to take the
state exams, and now their mandatory. Of course, in some
states, there are ways to difficult verge, but still, it was

kind of a huge shock for most teachers of the deaf to find

that their students needed to pass these tests, and they
were challenged in how to teach them to meet the
requirements. But there were very few resources to support
it, especially in science and math.
Now, before NCLB became law, a percent of teachers had a
bachelor's degree in their field who were teaching science?
Or any degree?
>>AUDIENCE MEMBER: I think 10%. There's another guess for
10%.
>>SCOTT WHITNEY: Try again. It would have been 20%. And
that is a sad situation.
Teachers would graduate. They might be teaching deaf
children biology or chemistry, but they had no background in
it themselves.
>>AUDIENCE MEMBER: Are you focussing specifically 0 on deaf
or is this generally for hearing? Do you mean deaf teachers
or hearing teachers?
>>SCOTT WHITNEY: Deaf education. Not deaf teachers, but
anyone teaching deaf children.
In the 1980s, we had some recent findings. Now, my research
was -- looked at the theoretical foundation for education.
And I borrowed this from a book I really love written by
Cluen and Stewart. And they had a passage where they talked
about teaching science, but they said that there were four
basic needs that included deaf children needed to have the
opportunity for a self expression, like -- I'm not talking
about body piercings, body modification.
I mean that as they internalize things and learn new things,
they need the opportunity to expressively communicate the
things they've taken in receptively.
Now, often that's done with -- teaching is
done pedantically. It's done through lecture.
The first need was authentic experiences. And what did we
mean by that?
>>AUDIENCE MEMBER: Having -- it's something that relates,
that they've experienced in their real lives themselves.
>>SCOTT WHITNEY: Yeah, that is faced in their life, that
the students are involved and engaged in doing science, not
just observing the teacher, or not contrived experiments.
A third need was for deaf children to have good role models.
I signed role models. I'm not sure what the sign would be
here. Role models.
>>AUDIENCE MEMBER: So do you have -- this is what you --
you have a role model yourself in science? Did you grow up

with something like that in your experience?
>>SCOTT WHITNEY: Yeah, I didn't really have role models,
no. I'd say Dr. Harry Lange has written several books, and
a dictionary, but, I mean, I can't -- but the students here
may have some good role models.
Think I they've developed some good materials here, but I

didn't have those myself.
Comets, this Web site is where you can find it.
Now, one of the things I've really focused on is integrated
vocabulary. What do I mean by integrated? I mean that
across the curriculum, all day, regardless of the subject
students are learning, we need to infuse the vocabulary from
the science curriculum. Math and history and English class.
So all day long, the use of this technical vocabulary
becomes normative. Anyone here practice karate or Judo or
martial arts? Anyone involved here in martial arts? I used
to. And my teacher told me that I would have to do things
again and again. It takes repetition before one develops
expertise. Practice makes perfect. And you have to do it
over and over and over again. You need constant exposure to
using it and practicing it before you can master it.
Now, one problem teachers have is low expectations. We see
the type of jargon we have in scientific fields, and they
think, oh, it's too challenging for my deaf students.
Please! Don't do that!
I mean, the vocabulary from the discipline is what the
students need exposure to. Once they get exposure and they
see these vocabulary again and again, the comprehension will
follow.
I mean, I can speak for my personal experience. I taught
deaf children for a number of years. And I did experience
significant frustration because I'd have a textbook, and I
couldn't figure how can I teach this vocabulary, how do I
teach these concepts? Things like predator, prey,
bioluminescence.
Anyone have a sign for predator? It's interesting,
Dr. Lange had a sign that looked kinda like capturing
something, and the index finger on the neutral hand would
probably be the prey, but -- or the prey's out in a neutral
space, but research found that most teachers didn't find
that an acceptable sign, so I don't think we've standardized
these terms yet in sign language. Bioluminescence. I don't
know if there's a standardly-accepted sign. I've seen this
used for bioluminescence. Array. I've seen this sign used
for array. Before I saw Dr. Lange and his dictionary, I

wasn't sure where to go with these, but we don't have enough
standardization and we don't have enough lexical items in
that dictionary or any dictionary.
I can offer you some resources I know about. One is
certainly this Comets Web site developed here at RIT.
Now, you noticed here, it might be hard to read, it says
please rate the conceptual accuracy of this sign using the
scale below. And it's a one to five scale. So Dr. Lange
didn't try to force people to accept the signs that were
being proposed. They proposed them and asked people to
watch examples of the signs and then provide feedback on the

level of acceptability. Plus, there was an opportunity to
provide comments.
Another idea for a resource, again that was developed by
Dr. Lange, was a picture dictionary. And what they did was
used the gloss for reptile, and then that was the basis for
the sign for alligator. And they had three items of
information that pictured the word and the sign.
I found a number of resources for technical signs.
Dr. Lange proposed some. I don't know if you find these
acceptable or not.
One idea I came up with, and I later found that other people
had the same idea, I can't claim it, was using Greek and
Latin roots.
Greek and Latin make up perhaps 75, 80% of the
English lexicon, and deaf children often don't have access
to the phonological roots of those words, so they can't
sound words out. Now, how can we help deaf students analyze
words and see what the roots are and use that as one code in
deciphering meaning?
For example, suppose we have one group, ASTR. There's quite
a number of words relate d to that root. Astronomy,
astrology, asterisk, and a whole bunch of other words and
what they have in common is some relationship to star, or
very large or perhaps very far away.
Now, when deaf children understand what that root means and
they see words incorporating it, they can do their own
analysis.
Now, if a word has no sign, what options do you have? What
are your choices?
Dr. Lange found that teachers were -- we were taking signs
from the films and evaluating how appropriate they were or
weren't.
Another source to find signs is Vlogs. People are familiar
with blogging. Video log or a video blog is often called a

Vlog. Sign negotiations is another way you can deal with
the problem.
Now, sign negotiation is a sticky issue. Really, for an
individual interpreter working with students in one class
over one time period, that might be acceptable, but that
doesn't mean it's going to generalize into the language, and
they're not proposing that it be generalized. What they're
saying is that interpreters need to work with their
consumers to negotiate signs for that use.
Now, the danger is often the deaf children may not
understand that that's being negotiated only for the purpose
of this class, and for ease of use. And they'll try to use
it generally and other people aren't going to understand
them because it's not part of the language.
Questions at this point?
Now let me focus on my research. My primary goal was to

provide more resources for people who were teaching science.
My doctoral dissertation focused on games, perhaps a
dissertation. I signed dissertation.
Now, what I focused on, vocabulary, but it was also broader
than that. I wanted to broaden out, again, doing additional
research focused on continuing discourse, connective
discourse.
The first thing I wanted to do is see if 3D animation was
worth doing. And the research results -- I'm sorry. A lot
of researchers currently have started developing different
3D animation models for ASL.
Now, no one posed the question first, should we do this? So
I wanted to do some research to see if, perhaps, it was
actually helpful.
And finally, I wanted to improve our techniques for
developing 3D animation.
My initial interest started at Lamar University. It's a
university in Texas.
I was wondering, I watched my mom play a game. I'd be lying
in bed, and I might need to go to the bathroom, and I'd see
that Mom was playing at 2 in the morning. At 2 a.m.! She
was that engaged! I mean, she was hooked on this game! And
I thought, huh. Okay. Games are that addictive. We can
don't that sort of passion and use it for education. So I
tried to develop a game, an educational game.
Why don't we start off with a quiz, eQuiz, if you will.
It's a pre test.
It opens with a film clip. Unfortunately it's not working
right now.

The children are presented with a problem they need to
solve. They need to clean Jimmy's wound with antiseptic,
and they need to kill the germs. So the children have to
figure out what they should use. And they'll just take a
guess.
Hurry, clean up Jimmy's wound is the response they get.
That says, good job. Keep going!
Now, the complete game -- you can kind of imagine what the
game would look like and how it plays out. Now, the result
of testing this out, some of the children really took off.
They learned quite a bit of information from the game, and
other children didn't really like it, so the results were
really varied. There were mixed results.
For the vocabulary items, some where they were really well
prepared for them, they did well with, and there's a level
of background knowledge sometimes before they started. Some
weren't as clearly presented, perhaps, and they struggled
more with those.
But for students who were well-prepared for this activity,
we saw some increases.
Some of the students learned using this as an education

technique really well, but like I said, the results were
mixed.
Now, the dissertation, that was my very first attempt trying
to use motion capture. Now, you have to realize, this was
my very initial attempt, so don't criticize it too harshly.
It's hard to comprehend what's being signed from this clip,
but it wasn't that bad. Far from perfect, but it was good
enough for me to want to continue this Avenue of research.
It seemed promising. So what is Motion Capture?
The definition of Motion Capture is using technology to
record the motion of actors and to duplicate those motions
using a 3D character. I mean, perhaps you saw the movie
Spiderman. They used live human performers, actors, but you
can't put a real human into some of those scenes and
actions, so they used Motion Capture. They put sensors in
different places on the body. And they were reflective.
And then they have lights around the studio. It's almost
like an infrared light, and then the motion that's reflected
off those reflectors is used to generate 3D shapes, which is
used in software.
Now, I use these sensors and this equipment to try and get
Motion Capture. I learned an important lesson, really
important lesson. Check this out. I learned this the hard
way!

Now, why Motion Capture? You know, we have film and video,
but it gobbles lots and lots of memory. File space for
storage, RAM to process. The files are really huge, and
they need monster hard drives to work with, and high
definition adds to the problem. You need even larger files.
With Motion Capture, you have really small file sizes.
And there's no sacrificing the image quality if you compress
the files. You can compress it with no loss. It's a
lossless compression.
Now, theoretically, you could connect lexical items serially
one at a time. Now, you can't really do that with film.
You can't randomly choose the items and then combine them.
This is randomly accessible.
And in theory, you can capture fine nuances much more
perfectly than you would using other techniques.
Now, from my experience, it didn't exactly play out that
well.
Perhaps you saw the work being done by Vcom 3D. They sell
software with 3D animation, and they have Avatars, and it's
for sign language. I'm really impressed with where their
work is going, but at the same time, it's so labor
intensive.
You need expert signers and they also need to have excellent
animation skills, and it's not easy to find people with that
combination of knowledge and skills.
>>AUDIENCE MEMBER: Talking to me?

>>SCOTT WHITNEY: Oh, you might have skills. Get in touch
with me.
Purdue University, I wasn't aware that Purdue University was
doing work. When I started my research I found later Purdue
University was pursuing the same track. I was working on
science. They were working on math.
I don't have time to really demonstrate what they were
doing. And then just this past January, I want to share
with you some of the very recent research I was doing in
January. I did some 3D Motion Capture and combined that
with QuickTime movies. I had vocabulary items, 60
vocabulary items. I did 30 signs in 3D animation and 30
signs I used a live signer and developed QuickTime movies
and then randomly I divided all these lexical items into
four units and I allowed the students to practice with this
before they took a test. And tried to see what their
preference was for videos of live actor signing or for 3D
animation.
Now, you know from statistics you should have an N of 30

above. I only had 16 students so there's one problem right there. But that's all I -- that's all the number of subjects I had.

The students were tested, and then retested. They had a chance to watch a signed performance and then pick which lexical item patched what they saw -- matched what they saw.

They got immediate feedback. And they had four trials.

They could do it four times. We found that was frustrating.

In the future, we'll cut back on the three trials.

Now, the way the project developed, I selected the signs for the RIT lexicon here, and then expanded that with common words, commonly-used words, but that had a specific meaning in the sciences.

Next I used the Motion Capture equipment to record the signs and imported them into a software program called Poser.

It's very popular 3D animation program for use with human characters and movement. And this wouldn't be appropriate for the public school because there are so many nude figures within the Poser program, I think in public schools it might be a problem at most grade levels.

And then I added the hand shapes and exported it to a 3D program, Engage. Oh, created a quiz engine.

It's easier to demonstrate this than it is to try and explain it.

So I randomly get a QuickTime movie, and you see this film clip, you can -- watch it again.

Now, you have to pick which lexical item would match that sign.

Now, it's interesting. I used my daughter as an alpha test to see if the software worked or not. Now, my daughter hears. And she guessed pretty consistently from the hand

shapes what those signs were.

So I had to add two signs that had a similar hand shape.

There was a distractor, so in the multiple choice items I built in a distractor with the same hand shape.

All right. That clip would be feline.

Now, eventually I'll be able to show you all the problems that were generated from this program as well, but you get a basic idea from what you've seen so far.

From the research that we've done so far, you see that you're able to keep going with this program. You could do sift sorts of research with it. Hand shapes for the program called Poser, and we've been able to capture different sorts of categories of information, different sorts of movement files, animation files, viewpoint files. So we have the

quiz engine, and we also have what you call a developer.
Additional vocabulary items available include animal signs,
and also for ASL I and ASL II curricula.
As for the results, most, although not a huge amount, differ
in terms of preferences about what sort of signing they
want, and why would that be? Why would there be a different
preference for live signers as opposed to something motion
captured, for animals and for 3D or what have you, why would
some people prefer a live animate signer? You saw feline
with both the person and the animation. Well, because
better facial expression seems to be one answer across the
board. And also one of the comments said it was too slow.
Somebody else thought something was too fast, so there's
differences in those preferences as well.
So how did the students learn from this particular software?
Okay. This was the first attempt, the first trial, and the
3D seemed to do a little bit better than the other two, or
than the other one, excuse me.
Trial two, a noticeable difference. Even better than
before.
And the third trial shows a fairly substantial difference as
well, so it does seem that the 3D had it over the QuickTime
display.
I wasn't satisfied yet. I wanted to analyze this further.
What if a student did better with the 3D presentation than
the QuickTime? What did that mean in the long run?
Here's students that did better with QuickTime, 9.50, but
those that did better with the 3D, negative 13. Now,
negative and positive, don't get troubled by that symbol
because it's just a descriptive value, and it's -- you take
the absolute value of it.
So you can see that it seems -- that the evidence upholds
the idea that the 3D is a stronger learning tool for the
students.
Conclusions about this whole project, it's not a hundred
percent certain. This is my first group, and as I said

before, it was a small sample size. 16 people is not enough
sample size to generalize and say categorically that 3D is
the better way to go between these two methods. Not yet.
So that does cause a problem.
In terms of confounding factors, quality control, two
different formats, and the quality's not always exactly the
same. There's not always a fair comparison. So you have to
struggle with capturing motion whether you're getting it
exactly right or not.

Dr. Lang had developed a 3D program in Motion Capture for his students, and I believe Maria is what it was called, and it requires several different repetitions and iterations to capture.

Sometimes a 3D is very slow to open, and the students just give up. Their attention span will not support them sitting and waiting for this thing to load. They've got the vocabulary and they're ready and they see it, they see the thing, and they want to have that instantaneous gratification to be able to press on something and get that image right away.

3D, as we noticed with the feline sign, was very slow compared to the QuickTime presentation of that sign, so that makes a big impact on the research when you take those factors into consideration.

Now, you're future plans are to continue this research, but then to flip it somewhat.

Now, before we had these movies that somebody would watch with four different choices and now we're going to flip it. We're going to have four different film clips. The student will watch them and click it and find the word -- no, wait a minute. Did I say that right? Yes. We'll have to find four different images for one word and they will pick the image that officially fits the word instead of the other way around.

The problem is that students may watch these, and again, they're going to get tired of waiting for these things to load and maybe they'll just venture a guess without being certain of their answer.

Way down -- oh, excuse me. Oh, time's a wasting.

So we have some solution to this. Organic motions. So sometimes should we wear regular clothing? And is that captured well on regular cameras instead of wearing special equipment? Perhaps just having, you know, regular clothing and not having all the fancy equipment is a better way to go. But would that be an equal image for somebody to see to a live person. Also, facial expression, hand movements, and manipulating that, like I said before, setting that up is very confusing. Oh, no time for questions?

>>MODERATOR: We have another workshop starting at 11, so if you have questions, please feel free to approach him outside

the door. Thank you so much for coming. Please complete the evaluations and give them to me. Thank you.