RESEARCH AT GALLAUDET

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Using an ASL/English Bilingual Approach to Help Deaf Students Understand and Solve Math Word Problems

By Alexander Zernovoj*

Alexander Zernovoj

One of the most widely discussed statistics in the field of deaf education is that on the reading portion of the Stanford Achievement Test 18-year-old deaf students perform on average between a 3rd and 4th grade level. They do better on math portions (median scores at a 5th grade level), but they are still at a disadvantage when math questions are posed in English sentences. As standards-based tests become "high stakes" tests in many states, performing at this level may prevent deaf students from getting a diploma, being accepted in college, or getting a good job. Additionally, after devoting so much time and energy to increasing students' English literacy, teachers often do not have enough time left to teach many subjects required by state standards. There is little question in other words, that there is a need for effective strategies to help deaf students improve their literacy skills.

In light of these challenges, considerable attention has been devoted to pedagogical and language acquisition research that explores ways to improve the English reading and writing skills of deaf students. Equally

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Gallaudet Chosen as Site of National Science of Learning Center on Visual Language and Learning

By Todd Byrd* and VL^2 researchers

Gallaudet has been chosen as the site of a national science of learning center devoted to cultivating better understanding of visual language and visual learning, thanks to a large grant from the National Science Foundation (NSF).

Specifically, The NSF has awarded Gallaudet $3.5 million over two years to establish the Science of Learning Center on Visual Language and Visual Learning (VL^2). The purpose of VL^2 is to gain a greater understanding of the biological, cognitive, linguistic, socio-cultural, and pedagogical conditions that influence the acquisition of language and knowledge through the visual modality. If successful, NSF will fund an additional three years of VL^2 at a level of $4 million per year. At the end of the five-year cycle, VL^2 could receive another five-year grant at the level of $4 million per year. The total funding for VL^2 could be $35.5 million over the next 10 years.

VL^2 is one of six NSF Science of Learning Centers. Three of the centers were funded in October 2006: VL^2, The Temporal Dynamics of Learning, University of California, San Diego; and Spatial Intelligence and Learning Center, Temple University, Philadelphia, Pa. The other three centers were funded two years ago during the first round of competition: The LIFE Center (Learning in Informal and Formal Environments), University of Washington, Seattle; CELEST: A Center

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*Todd Byrd is editor of *On the Green*, the campus newspaper for Gallaudet University in Washington, DC.

ASL/English Bilingual Approach,

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important is the development of academic language in mathematics. For this reason, while doing graduate work at the University of California, San Diego, in 2005, I designed an approach to develop American Sign Language (ASL) and English academic language in deaf students across two domains: literacy and mathematics. In 2005, I wrote a thesis, *Telling, Writing and Reading Number Tales in ASL and English Academic Languages* (Zernovoj, 2005) in an effort to outline a bilingual approach to teaching deaf students that would promote the students' math word problem solving skills. This curriculum offered ways to teach both number sense and math concepts through number tales, while at the same time improving the ASL and English academic language and literacy skills of deaf students.

Many teachers and researchers say deaf students' difficulties with math word problems can be attributed both to inadequate reading ability in English and uncertainty about how to choose the correct operation to apply to such problems. These students are "emerging bilinguals" in ASL and English and encounter many challenges acquiring the necessary academic language to solve problems that involve both math and English. Since deaf students have full sensory access to ASL, however, I hypothesized that by developing and implementing a mathematical word problem curriculum based on telling, reading, and writing number tales using both ASL and English, deaf students' mathematical and English literacy skills would both improve.

The curriculum I developed was also designed to make number tales relevant to deaf students' experiences. In this curriculum, a "number tale" was any story that had number quantities or amounts embedded in the narrative. The curriculum mainly focused on word problems, which can be thought of as number tales containing certain number facts and a question arising from these facts.

The Rationale for Using a Bilingual Approach with Deaf Students

In the design of this curriculum, ASL-English bilingual teaching and learning practices were used to support the development of academic language. I based the curriculum on the common sense observation that the development and use of both ASL and English academic language are prerequisites for deaf students to communicate and characterize complex and abstract mathematical concepts. For instance, the students first used ASL academic language to tell ASL number tales. The students then used English academic language to read and write English number tales. By using either of the two academic languages to discuss mathematical ideas and numbers, the students acquired experience and knowledge needed to improve both their number sense and their understanding of given mathematical concepts.

Some researchers consider the bilingual approach to be student-centered education because it is conducted using the child's most accessible and potentially fluent language (ASL) while fostering a child's literacy in English. Numerous recent studies have focused on the relationship between ASL fluency and English proficiency, and found that deaf students' fluency in ASL can be taken advantage of in achieving English proficiency.

Research at Gallaudet is available free of charge. Address inquiries to Research at Gallaudet, Gallaudet Research Institute, Gallaudet University, 800 Florida Ave., NE, Washington, DC 20002-3660. Phone: (202) 651-5995 (V/TTY). Contributing to this issue were Alexander Zernovoj, Todd Byrd, and VL2 research staff. Special thanks are due to Pat O'Rourke and Tom Humphries for permission to reprint the example of a glossed ASL sentence on page three. Readers interested in the the book *A Basic Course in American Sign Language* are encouraged to contact Pat O'Rourke, T J Publishers, 2544 Tarpley Road, Suite 108, Carrollton, TX 75006, phone 1-800-999-1168. Comments related to articles in this issue are welcomed by the editor and may be sent by e-mail to Robert.C.Johnson@gallaudet.edu.

Robert Clover Johnson, Senior Research Editor

Alexander Zernovoj, Walter Ross Fellow

Padden and Ramsey (2000) looked at how ASL plays a role in the reading development of deaf children, whose early experiences involved exposure to and use of sign language combined with early exposure to printed English. They measured the ASL competence of these children by testing specific ASL skills, evaluated how well the children knew the association between certain ASL signs and their English word counterparts, and assessed their fingerspelling skills. They found that these students "have made an alternate discovery in which they form associations between elements of a signed language and elements of written language as they acquire the ability to read" (Padden & Ramsey, 2000, p. 168). Padden and Ramsey's research shows that when given the opportunity, deaf children actively seek links between accessible systems – not between words they cannot hear or speak, but between ASL fingerspelled signs and ASL signs that have been linked in some tangible, memorable way to English print words. In other words, deaf students actively search for connections and understandings by forming correspondences between fingerspelling and written spelling systems and ASL signing.

One way students can make meaningful connections between ASL signs and English print is by using fingerspelling, pointing at English words, and using ASL signs in rapid succession. This procedure has been called "chaining" in several studies (e.g., Humphries & MacDougall, 1997; and Bailes, 1998). Since fingerspelling is seen as a technique used for representing English letters with ASL signs, Bailes wrote in her study of deaf children in a bilingual program that it "played a key role in the teaching of English letters, words, phrases, and syntax" (p.189). Bailes showed a perfect example of this in her dissertation, quoting one teacher-participant in her interview:

> "I sign first in ASL, then fingerspell, and then write the word or point to the written English. As a simple example, let's take your name C-I-N-D-Y, you signed it with your name sign for the children, and then fingerspelled it. Then I wrote 'Cindy' on the board, then again fingerspelled it, telling the children INDEX NAME C-I-N-D-Y. The children got this quickly and recently asked me: WHERE C-I-N-D-Y? I know you introduced yourself in your sign name, but they are fingerspelling your name, showing they understand the English equivalent" (Bailes, 1998, p.181).

In other words, teachers were able to use fingerspelling to clearly represent and emphasize English words to deaf students and bridge the gap between their grasp of ASL and printed English.

Singleton, Suppalla, Litchfield, and Schely (1998) had a similar finding when they investigated ASL-based techniques for learning print English. In their investigation of several studies, they found that when students receive ASL pre-reading lessons, their comprehension of the printed English text improved. They also found that in English translation activities, students improved their English writing skills when they produced ASL narratives and then developed written English narratives using English glosses from their ASL narratives (see Figure 1). A gloss of ASL is a written sequence that makes use of English words, printed in all capital letters, to suggest the sequence and use of ASL signs. These same glosses were used by students to compare ASL to English narratives, and eventually to develop an English translation of their story. Based on these findings, Singleton et al. concluded that paying attention to, analyzing, and mastering the linguistic features of ASL can be strongly connected to English literacy skills. These findings and the students' desire to seek links between ASL and printed English were the basis for the development of my curriculum, which I will describe further in the "Curriculum Design and Implementation" section of this article.

Gloss: BREAKFAST TIME 8
English: Breakfast is at 8 o'clock.

Figure 1. English gloss of ASL sentence

Field-Test Site and Student Demographics

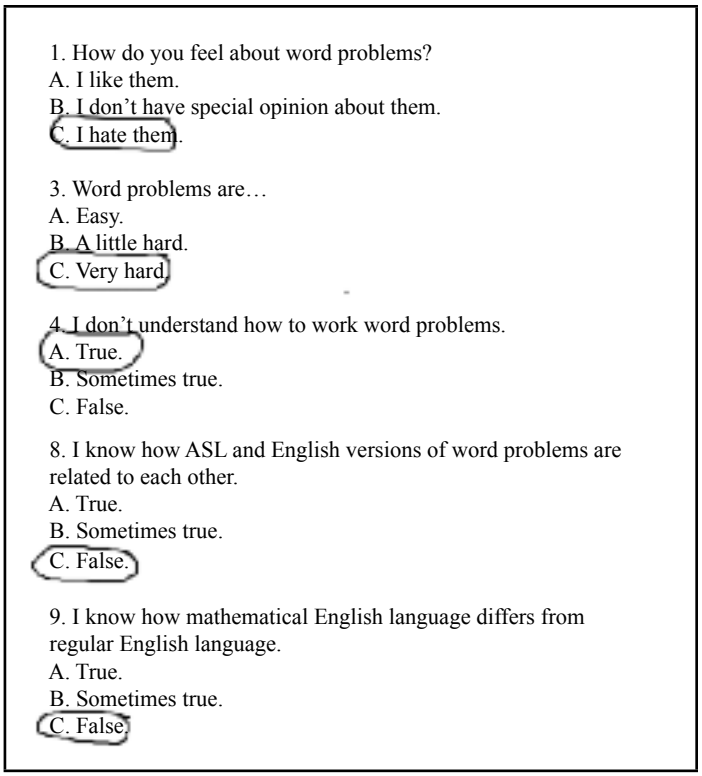
During Spring 2005, I field-tested the curriculum in a fourth grade classroom consisting of six deaf students – four girls and two boys – at a state residential school for the deaf where most of the staff was deaf. This school was known for its innovative ASL-English bilingual approach to educating deaf students. One of the students was a third grader while the other five students were fourth graders. One student in this classroom was Caucasian, and the rest were either Hispanic or of Native American descent, or both. All were fluent ASL signers, and half of them came from Deaf families that used ASL as the main mode of communication. The other students had hearing families whose immediate family members (mainly parents and siblings of the student) signed well enough to communicate on an everyday basis.

The cooperating fourth grade teacher was also Deaf (as I am) with native fluency in ASL. All six students stayed in this classroom for fourth grade lessons: Morning Meeting, Literacy Center, Accelerated Reader, Sign Aloud, Writer's Workshop, Science, and Social Studies. The school structured mathematics classes according to each student's cognitive level. The classroom itself was an English print-rich environment consisting of vocabulary words, labels, and other information on the walls. English-print children books, dictionaries and other reading materials were all over the classroom, mainly on the shelves.

Curriculum Design and Implementation

Before implementation of the curriculum, the mathematical word problem survey (Figure 2) and pretest were administered to help determine the students' views regarding word problems, and assess their cumulative knowledge, skills, and tools they could use for understanding and solving word problems. At the end of the curriculum, students retook the same survey and posttest to show if their views had changed, and what knowledge, skills, and tools they acquired resulting from the implementation of this curriculum.

The first unit focused on students creating their own ASL number tales (or ASL narratives). Before students created their own tales, they compared teacher-produced ASL tales to word problems to find, analyze, and understand the similarities and differences between the tales and word problems. These comparisons gave the students the necessary knowledge of mathematical concepts and ASL and English linguistic features, which would help them create their own number tales. Students then worked together to develop individual ASL tales based on their own experiences that incorporated numbers. During the planning and creation of number tales, students learned (1) how to think critically, (2) how to select appropriate word (or sign) choices for the given tale, and (3) how to evaluate their own and others' number tales. Student-created ASL tales were videotaped for later use to help support the students in writing their English version.



1. How do you feel about word problems?
A. I like them.
B. I don't have special opinion about them.
C. I hate them.

3. Word problems are…
A. Easy.
B. A little hard.
C. Very hard.

4. I don't understand how to work word problems.
A. True.
B. Sometimes true.
C. False.

8. I know how ASL and English versions of word problems are related to each other.
A. True.
B. Sometimes true.
C. False.

9. I know how mathematical English language differs from regular English language.
A. True.
B. Sometimes true.
C. False.

Figure 2. Typical Responses to Select Questions from Curriculum's Word Problem Survey at Beginning of Study

The second unit of this curriculum focused on reading and solving word problems based on their prior knowledge and experience. A variety of number tales, and how they are related to each other, were also discussed along the way.

In the third unit of this curriculum, students revisited their ASL videotaped tales and retold them in English. Students compared both ASL and English versions of number tales, and discussed similarities and differences. These discussions resulted in the development of metalinguistic awareness of both ASL and English in students. The students also discussed what makes a good English number tale, planned and wrote English versions of their ASL tales, and edited their English writings. However, because of time limits, no English glosses from their ASL narratives were used to write written English versions. The students wrote their English versions, as best they could, using the source straight from their videotaped ASL number tales. In the end, students produced a cumulative project, which included both videotapes of students' ASL number-tale creations, and their written English versions of their ASL creations accompanied by drawings.

I wrote field observation notes on each day of the implementation of this curriculum documenting everything I thought notable, ranging from individual and whole group learning progress of the participating students. These observation notes were used to evaluate the effectiveness of my bilingual-based curriculum. Additionally, during the implementation, I used student performance rubrics to measure progress in student learning on both an individual and whole group basis. Not only were field observation notes and student rubrics used to measure student progress, the student artifacts (pre-and-post-tests and student-produced ASL and English word problems) were also used as important evidence that showed the extent of the progress of student learning throughout the curriculum implementation. Throughout the three units of this curriculum, students developed their ASL and English mathematical language (or "math talk") by learning key mathematical vocabulary words and phrases.

Evaluation and Conclusions

The compiled data analyzed in this research provided evidence that this curriculum's goals were met in a variety of ways. For this article, some of the curriculum's goals (all of which were accomplished) will be discussed, and, for the most part, only anecdotes derived from my field observation notes are used to discuss each of two of the curriculum's goals and the outcomes for that goal.

One of the curriculum's goals was to develop and increase students' metalinguistic awareness of both ASL and English through telling and comparing of ASL and English versions of stories incorporating numbers. Having metalinguistic awareness of both ASL and English can be quite useful since analyzing ones' own knowledge of language and how to use it can help students deepen their understanding about number tales in addition to understanding word problems. In the beginning of the curriculum, all students read and signed both number tales and word problems word for word in English word order. By the time the curriculum was over after so many discussions, and reading and signing practices, all students improved in their ability to read

and summarize both number tales and word problems in ASL.

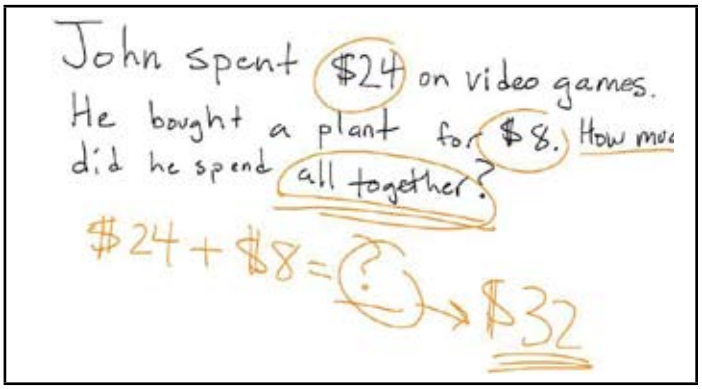


Figure 3. "Joining All" Word Problem

Having the students read and sign number tales and word problems during the strategy mini-lessons and other times helped students and myself to recognize and discuss important linguistic elements that needed improvement. Each time a linguistic element needing improvement was identified, a teachable moment occurred when I took the opportunity to point out and discuss that linguistic element with the students. That happened several times. For instance, during a discussion about how students solved a word problem (Figure 3), I noticed that the students were signing the English phrase "all together" as two signs in ASL, "ALL TOGETHER." After correcting their signs by discussing with the students how to sign the English phrase more accurately in ASL, they were consistently signing it as "ALL+TOGETHER" (the same sign used for "SUM" that also has the same meaning as "ALL+TOGETHER"). Several days and weeks after that discussion, I kept noticing that the students consistently signed "ALL+TOGETHER" instead of "ALL TOGETHER" when I pointed to the English phrase "all together" and asked them to sign it again. This demonstrated that the students improved their metalinguistic awareness of how the phrase "all together" in ASL and English are related to each other.

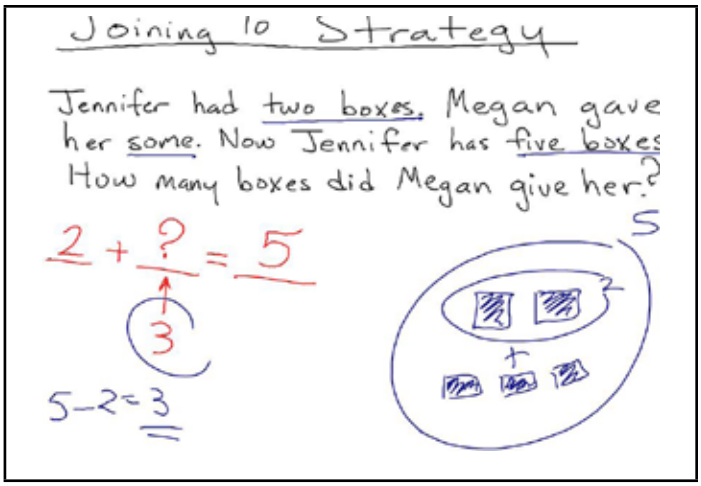


Figure 4. "Joining To" Word Problem

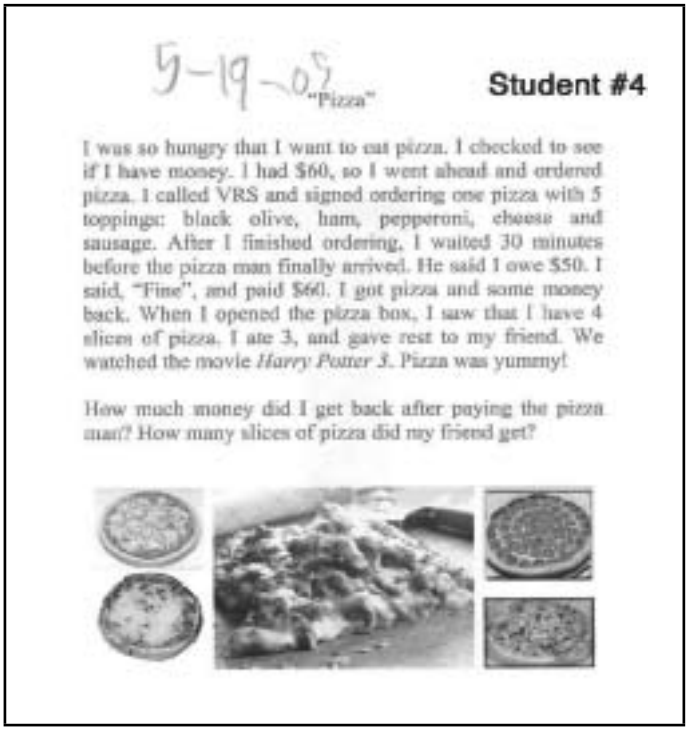
Another one of the curriculum's goals was to develop students' mathematical language (or "math talk") in both ASL and English. Development of students' mathematical language is vital for students' ability to talk about their math thinking, and to share it with others during mathematical activities. Students' mathematical language proficiencies may not always be equivalent in ASL and English. Some students may be lacking proficiency in one or *both* of these languages; hence, the importance of developing students' mathematical language in both of these languages through both number tales and word problems.

All of the recorded dialogues between the teacher and the students show that the students have actively been developing and increasing their academic language in ASL by discussing how they solved a given word problem and what strategy they used. For instance, in the transcript from one day during the implementation, the students and I discussed how to solve a given "Joining To Strategy" word problem (Figure 4). During that discussion, the students used their mathematical academic language to articulate how they solved a problem. Students #3 and #4 compared how many boxes Jennifer had before and after she received more boxes. They stated that Jennifer at first had two boxes, received some more, and then had five boxes. They said this raised the question of how many more boxes Jennifer got. They also said that they knew that the two sets (two and five) needed to be compared and that they needed to subtract one set from the other to get the difference, which was the answer. After comparing and computing,

they concluded that the answer was three, which was correct. They were using mathematical language when they articulated how they solved the "Joining To Strategy" word problem, and when they compared and contrasted the numbers in the problem. Additionally, the students were using key mathematical terms during the discussion, as shown in the transcript, such as number words, "more than," "minus," "subtract," and "add," all of which showed that they were using mathematical academic language in the discussion.

The students developed and increased their English academic language. The students' planning, creating, and editing of their written English version of their ASL number tales made this development and improvement possible. When editing their English tales, the students worked with their partners reading and giving feedback on their English versions of their ASL tales. They helped each other when picking the specific English words and phrases that might best represent the meaning of their signed ASL phrases. Through editing their work with their partner's and my help, the students were able to build on their English vocabulary and their English skills. Looking at the students' initial and subsequent drafts up to their final draft, it was apparent that the students increased their academic language in English (Figure 5).

In closing, students' pretests and posttests captured improvement in all four students' overall word problem test scores. On the pretest, Student #1 got 8 out of 15 problems right (53.3%), but on the posttest, she got 12 out of 15 problems right (80%). Student #2 got 10 out of 15 problems right (66.6%) on her pretest, but on the posttest, she got 13 out of 15 problems right (86.6%). Student #3 answered 9 out of 15 problems right (60%) on her pretest, but she improved greatly, answering 13 out of 15 problems right (86.6%) on her posttest. Student #4 did not do well on his pretest, getting only 4 out of 15 problems right (26.6%), but he did much better on his posttest where he got 9 out of 15 problems correct (60%). These gains in student scores on the pre- and post-tests from the beginning to the end of the curriculum reflected the success of the students' overall learning as they acquired and maintained word problem solving strategies and tools from this curriculum.


5-19-05 "Pizza"

Student #4

I was so hungry that I want to eat pizza. I checked to see if I have money. I had $60, so I went ahead and ordered pizza. I called VRS and signed ordering one pizza with 5 toppings: black olive, ham, pepperoni, cheese and sausage. After I finished ordering, I waited 30 minutes before the pizza man finally arrived. He said I owe $50. I said, "Fine", and paid $60. I got pizza and some money back. When I opened the pizza box, I saw that I have 4 slices of pizza. I ate 3, and gave rest to my friend. We watched the movie *Harry Potter 3*. Pizza was yummy!

How much money did I get back after paying the pizza man? How many slices of pizza did my friend get?

Figure 5. One of the students' final drafts

My evaluation above shows that the curriculum's results were remarkable. In addition to acquiring and maintaining word problem solving strategies and tools, they became more confident in their ability to read and solve addition- and subtraction-based word problems. This was evident in all four students' gains in word problem test scores from their pretest to post-test. Students developed and increased both their metalinguistic awareness of ASL and English, and their proficiency in ASL and English mathematical language, or "math talk". They also all paid attention to and analyzed the linguistic features of both ASL and English, and compared them. This provided links between linguistic features of ASL and English literacy skills. Based on the quality of their self-produced mathematic class books, the students demonstrated their learning from this curriculum. The results of the student performance rubrics for the teacher and the students further confirmed this.

In addition to the rubric results, the surveys show that before the curriculum was implemented, most students hated word problems, but by the end of the experience most liked word problems. The surveys also showed that the students' view on whether they understood

how to work word problems generally changed from being negative to positive. At the end of the lessons, they thought word problems were okay, and were more optimistic about their word problem solving skills (see Figure 6). Improvements in the students' attitude toward word problems and their ability to read and solve them were gratifying achievements in themselves.

On reflection, I asked myself: "Was the curriculum successful?" Based on data collected and analyzed, my answer is yes. This curriculum is flexible enough to be used with students at different levels, and can be modified by introducing other mathematical concepts (e.g., multiplication- and division-based word problems). While I hope that others will implement this approach, I also plan to continue field-testing this curriculum with future students for further evaluation of what works and does not work.

1. How do you feel about word problems?
A. I like them.
B. I don't have special opinion about them.
C. I hate them.

3. Word problems are…
A. Easy.
B. A little hard.
C. Very hard.

4. I don't understand how to work word problems.
A. True.
B. Sometimes true.
C. False.

8. I know how ASL and English versions of word problems are related to each other.
A. True.
B. Sometimes true.
C. False.

9. I know how mathematical English language differs from regular English language.
A. True.
B. Sometimes true.
C. False.

Figure 6. Typical Responses to Select Questions from Curriculum's Word Problem Survey at End of Study

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Humphries, T., & MacDougall, F. (1997). *Adding links*

The Retirement of Dr. Michael Karchmer

By Robert C. Johnson

Dr. Michael Karchmer retired on February 3, 2007, capping a distinguished career at Gallaudet University that spanned 31 years. He began his work at Gallaudet as a research scientist in the Office of Demographic Studies (ODS). Later he was associate dean for the Gallaudet Research Institute and dean of the Graduate School and Research. Throughout his career, he also served as a faculty member in the Department of Educational Foundations and Research. He finished his tenure at Gallaudet as the director of the Gallaudet Research Institute.

Michael Karchmer

Michael is well known for his research in areas concerning the education of deaf children and is the author of several important studies. Among his notable contributions are *Deaf Children in America* (with Schildroth), *Context, Cognition, and Deafness* (with Clark and Marschark), *The Study of Signed Languages: Essays in Honor of William C. Stokoe* (with Armstrong and Van Cleve), and "Demographic and Achievement Characteristics of Deaf and Hard-of-Hearing Students" (with Mitchell) in the *Oxford Handbook of Deaf Studies, Language, and Education*. He is distinguished not only by his scholarship but by his service to the field as well. Most recently, he served on the general advisory committee of the National Accessible Reading Assessment Projects (NARAP). In recognition of his many contributions to the field, he was given the Edward Fay Award by the Conference of Educational Administrators of Schools and Programs for the Deaf (CEASD) in 2005.

Throughout his career at Gallaudet, Michael has been a wise and amiable friend to faculty, staff, students, and colleagues in the field. He will always be appreciated for his humor and many kindnesses over the years. While we celebrate his retirement, we will miss his good counsel and boundless encouragement.

Learning Center on VL^2,

Continued from Page 1

for Learning in Education, Science, and Technology, Boston University; and Pittsburgh Science of Learning Center, Carnegie Mellon University.

The VL^2 proposal has been under development and review by NSF for more than three years. Under the leadership of the center's director, Dr. Thomas Allen, dean of Gallaudet's Graduate School and Professional Programs, VL^2 was first submitted as an NSF catalyst grant, designed to help universities prepare for the larger applications and establish inter-disciplinary and cross-university teams. As part of the catalyst award, Gallaudet sponsored a landmark meeting in April 2005 of deaf and hearing researchers from the disciplines of neuroscience, psychology, linguistics, computer science, hearing and speech science, and education. From this meeting a team of leading scientists and educators from these disciplines from around the country began to work on the proposal that has led to the granting of the award.

Thomas Allen

VL^2 will be housed on campus, and will bring together deaf and hearing researchers and educators from a variety of disciplines to explore how deaf people acquire visual language and learn to read. Despite current theories of learning that assume a central role for speech and hearing for language acquisition and literacy development, deaf people effortlessly acquire visual (signed) languages and are able through visual strategies to learn how to read and write. VL^2 therefore challenges current theories and will contribute to the general knowledge of the science of learning. This knowledge will benefit both deaf and hearing learners.

In addition to drawing on the expertise of campus researchers, VL^2 will collaborate with researchers from Georgetown and Rutgers Universities, the Universities of California-Davis, New Mexico, and Illinois at Urbana-Champaign, the Rochester Institute of Technology, and Boston University.

"This is a hugely significant grant, not only for Gallaudet University, but for the entire field of learning scientists, especially those who seek to understand processes of learning for visual learners," said Allen. "Not only does VL^2 have the potential to transform the science of learning, it will bring deaf researchers into the mainstream of scientific thought about learning and cognition, and, it will bring many esteemed hearing and deaf scholars to campus to interact with our community. Already, in its short life, VL^2 has begun to break down barriers among deaf and hearing researchers, among scientists from different disciplines, and among researchers and practitioners in education. The dissolution of these disciplinary and human barriers is at the core of the NSF Science of Learning Center philosophy. When people holding different perspectives come together to discuss research, the science is improved."

VL2 Initiatives

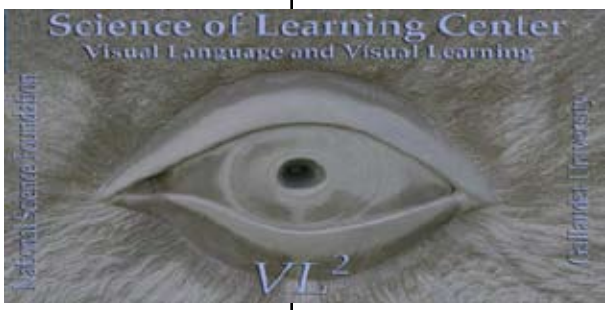
Six key initiatives serve to focus research activities in the center. These establish research-directed priorities for the allocation and management of organization resources. The Center's three Research Initiatives center on understanding visual language and visual learning in deaf children and adults. Three Organizational Initiatives ensure diversity of participation and a commitment to research-to-practice, and they provide new technologies and ethical guidelines for conducting visual language and visual learning research.

Initiative #1: Visual Language Acquisition. VL^2's studies of language acquisition seek to explain how biological and environmental factors interact to contribute to visual language acquisition. There is growing acceptance that language acquisition in humans reflects a biologically-governed maturation of symbolic systems that is triggered and shaped by environmental input. Neither strict genetic determinism nor an environmentally driven account of language acquisition can fully capture the intricate details of its development nor the richness of the resulting systems of human language.

Early sign language research has focused on the commonalities between developmental milestones in deaf children exposed to signed languages and hearing children acquiring spoken languages. This initial research was important in helping the scientific community acknowledge the validity of naturally

occurring signed languages. The aim of the Visual Language Acquisition Initiative (VLAI) is to provide the most complete picture to date of how sign language is typically acquired and developed across the life span and to describe the social-cultural interactions and practices which promote skilled use of a signed language. One important goal within the VLAI is to document normative stages of language acquisition that will provide clear benchmarks for researchers, parents, educators, and clinicians. The VLAI acknowledges the vast heterogeneity in language skills, communicative systems, and educational practice that are pertinent to the deaf child's acquisition of visual language. Careful consideration of these variables will constitute an important aspect of the research conducted under this initiative.

Initiative #2: Literacy Development. Current theories of reading and literacy development acknowledge the primary importance of a learner's phonemic awareness of speech. Yet, some deaf individuals become highly proficient readers without reliance upon the auditory-speech mode. The goal of the Literacy Development Initiative (LDI) is to explain this paradox and the means by which profoundly deaf individuals may achieve proficiency in reading. Researchers investigate a variety of critical components that support literacy acquisition, such as orthography, vocabulary, visual-based representations of English phonological structure, and cognitively-engaging discourse. These components are used by teachers and learners in context, and examining their respective roles in literacy development will lead to a more complete picture of the successful deaf reader. In turn, LDI researchers will translate their research discoveries into tangible learning practices that can be field-tested and ramped up for successful implementation in the education of all deaf children. Together, these efforts will provide new insights for theories of reading and illuminate the multiple factors and pathways that are available in mapping print to meaning. It is hoped that the discoveries from this initiative will not only be beneficial to deaf children, but will also provide alternative approaches for educating hearing children.



Initiative #3: Inter-Language and Inter-Modal Language Mapping. Today's deaf child must navigate a multi-faceted linguistic and visual landscape. The challenges to language acquisition in America are amplified by the multiplicity of the existing languages (e.g. English, Spanish, ASL, etc.) as well as by the differences in modality of language forms (signing, fingerspelling, gesture, cueing, speech, and print). Adding to these is the richness of available visual media (text messaging, captioned video, Internet, movies etc.). The Inter-Language and Inter-Modal Language Mapping Initiative seeks to understand the optimal methods for forming connections between visual linguistic and visual knowledge domains. Researchers plan to draw insights from studies of bilingualism, while at the same time recognizing that this provides only a partial account of the complexities faced by deaf children. The richness of today's visual and linguistic environment invites inquiries into cultural practices, educational schemes, and neurocognitive and linguistic representations of visual language, as well as learning practices that promote language and literacy development.

Initiative #4: Research-to-Practice. VL^2 strives not only to find ways to improve educational practices through the application of research findings, but also to improve the quality of scientific inquiry via input provided by teachers. This Research-to-Practice (RTP) initiative will benefit from pre-existing organizations, including the Center for ASL/English Bilingual Education and Research (CAEBER), which moved to Gallaudet in January, 2007. CAEBER will establish an RTP Core Management team to coordinate the efforts of VL^2 with Gallaudet's Laurent Clerc National Deaf Education Center (Exemplary Programs and Research Unit), Gallaudet's Department of Education, and the Gallaudet Leadership Institute to ensure effective and efficient production and dissemination of materials, sponsorship of teacher and administrator workshops, and access to school systems throughout the U.S. CAEBER and the Clerc Center also work closely with the Gallaudet Department of Education's Deaf Education Teacher Training Program to integrate

emerging principles of visual learning into teacher training curricula. CAEBER and the Clerc Center will function as the primary conduit for sharing information and facilitating communication between VL^2 and educational professionals, communities of deaf people, and parents.

Initiative #5: Diversity in Education and Research. VL^2 is committed to the inclusion of individuals from diverse backgrounds and under-represented populations. In particular, the projects to be conducted in the Center are reliant on the involvement of deaf scholars. The management team includes deaf leaders and VL^2 also supports the training of deaf students at the undergraduate, graduate, and post-doctoral levels. Numerous activities will be put in place to promote diversity within VL^2. These include the further recruitment of deaf scholars, active participation of diverse teacher-practitioners in the design and implementation of research, active recruitment of diverse students at all levels, and inclusion of diverse perspectives in advisory boards.

Initiative #6 Computational and Human Studies Infrastructure. This initiative focuses on developing and improving technology and guiding principles vital to research concerning sign language discourse and optimal educational practices with deaf students. It is hoped, for instance, that videos of classroom interaction can be made available in computer-accessible databases that VL^2 researchers can analyze from different perspectives and disciplines. This initiative aims to employ computers linked via Blackboard, video logs, I-Chat, I-Mac, and other tools. Principles will be established to ensure that the rights of human subjects will be protected in every aspect of VL^2's research on visual language and visual learning.

VL^2 Gallaudet Staff

Corine Bickley,
Engineer

Diane Clark,
Internal Evaluator

Paul Dudis,
Domain Leader

Steve Nover,
Research-to-Practice Manager

Carlene Thumann-Prezioso,
Administrative Director

VL^2 External Staff (not-pictured)

David Corina, Co-Science Director; University of California, Davis
Guinevere Eden, Co-Science Director; Georgetown University
Peter Hauser, Domain Leader; National Technical Institute for the Deaf, RIT
Marlon Kuntze, Domain Leader; Boston University
John McLaughlin, External Evaluator; Managing for Results
Dimitris Metaxas, Computation/Imaging; Rutgers University
Jill Morford, Domain Leader; University of New Mexico
Jenny Singleton, Domain Leader; University of Illnois at Urbana-Champaign

GRI Seeks Applicants for Powrie Doctor Chair

The Powrie V. Doctor Chair of Deaf Studies at Gallaudet University was established to bring scholars to the Gallaudet campus where they can contribute to the intellectual and/or creative life of the university and the Deaf community. The Doctor Chair provides support, guidance, and professional recognition to innovators whose work and ideas will have long-term impact on the Deaf community and/or enhance the quality of deaf people's lives. This appointment creates an opportunity for new perspectives to emerge. The recipient of the Doctor Chair receives a salary, housing, office space, and other support services on the Gallaudet campus. The appointment is available for academic year 2008-2009. Applications/nominations for appointment to the Powrie V. Doctor Chair should be submitted by postal mail to Senda Benaissa, Gallaudet Research Institute, HMB S430, 800 Florida Ave. NE, Washington, DC 20002 or by e-mail to senda.benaissa@gallaudet.edu or sally.dunn@gallaudet.edu.

2006 Gallaudet Alumni Survey Completed

In 2006, the GRI conducted a survey of Gallaudet alumni to learn how they are doing and how they believe their experiences at Gallaudet affected their lives. Of 11,625 alumni contacted, 3,928, including members of every class from 1938 to 2006, responded with the requested information, which has now been analyzed and published in a report available on the web at http://research.gallaudet.edu/Alumni/report.pdf

Some findings are worth emphasizing. Gallaudet graduates have earned master's and doctoral degrees in greater proportion than their national comparison group and have obtained full-time employment in roughly equal proportion. Earnings among Gallaudet graduates also compare favorably, though income levels are generally lower, largely because many Gallaudet graduates work in modest-paying employment sectors such as education and government. Especially for graduates who found employment highly related to their major, alumni expressed strong satisfaction with the university and would choose their alma mater again in equal (undergraduate) or greater (graduate) proportion than a national comparison group.

The fact that Gallaudet University is a deaf-friendly environment was the most important factor in influencing the decision of alumni to attend the university. The majority of undergraduate alumni were very much persuaded by the opportunity for association with deaf people, ease of communication, and the social environment at Gallaudet. A majority of the graduate alumni were very much influenced by the types of programs available and the good academic reputation of Gallaudet as well as the deaf-friendly environment that attracted undergraduate alumni.

Deaf culture and American Sign Language are also the most popular specific items for which undergraduate alumni report that their Gallaudet education very much contributed to their development. These aspects of the Gallaudet experience are not just attractive to those who matriculated in the undergraduate college; they are perceived as central contributions to the lives of these alumni. Additionally, a majority of bachelor's degree-holding alumni perceived that Gallaudet contributed very much to their abilities in nearly all facets of "human experiences and knowledge" and "self-awareness, ethics, and social responsibility."

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