The Curriculum Summit: A Conversation about Curricular Priorities

Diane: Welcome to the Curriculum Summit which is being presented in partnership with the National Alternate Assessment Center, the National Center on Education Outcomes, and the University of North Carolina at Charlotte Project Mastery. With me today are colleagues with whom we have collaborated for the last several years on alignment of alternate assessment and linking instruction to state standards. The team includes my colleague in severe disabilities Fred Spooner….in reading/ language arts Maryann Mraz and Bob Rickelman….in math Dave Pugalee…and in science Warren DiBiase (each say hello as I mention their names). We have had an interesting journey learning how to teach academic content to students with significant cognitive disabilities. I am delighted to have with me today the folks whose expertise we tap whenever we need guidance. Each of these individuals is well known for writing and research in their own area of expertise, and I encourage you to get to know them better through the bios on our web site.

Let me mention at this time that there are materials on our website for your reference. It will be easier to follow some parts of our conversation if you have these materials. These can be found at http://education.uncc.edu/access/ under Curriculum Summit, on NAAC's website at http://www.naacpartners.org/upcomingEvents/0901225Summitt/default.aspx, or on NCEO's website at http://nceo.info/Teleconferences/tele17/.

Here you will find our agenda for this call, conceptual statements for the content areas, and a resource called "Work it Across." We also have included some discussion starters for your team. These may be used in professional development or as an icebreaker with a team who will be doing strategic planning for the state. We will be discussing many of these topics in today's call. We hope you will stay with us until the end.

We have three topics for today's call, including (a) to identify how to articulate a conceptual model for content that can be used as a guide in prioritizing and extending standards for students with significant cognitive disabilities, (b) to plan for future discussions between general and special educators, and (c) to explain the concept of differentiated expectations for achievement of grade level content. There are many ways we could spend today's time with you. We could review curricular expectations for the population, how they have changed, and whether this push for academic learning is the right direction. Instead what we want to do is invite you inside the conversations we are having about curricular extensions for students with significant cognitive disabilities. I think for most the conversations have moved beyond, "Should we teach academics?" to "What content do we teach?" We need road maps to guide us through if we are going to set priorities. We do not propose to answer all the questions about the difficult work required when aligning instruction and assessment. But we do hope to stimulate your thinking and offer some topics for *your* team.

Personnel Preparation

Diane: To get us started, I'd like to turn to my colleague Fred Spooner who has been involved in personnel preparation for over 25 years. What has been conventional wisdom about what are the competencies for teachers in low incidence?

Fred: In most cases there are courses like: systematic instruction (methods of instruction), community referenced instruction (e.g., we have a class in life skills), partnership with parents, positive behavior support, content of instruction, and transition planning.

Diane: To make learning in the general curriculum a higher priority for students with severe disabilities, what changes in this list of competencies? Does anything get eliminated? What needs to be added to our personnel prep programs in low incidence?

Fred: Teachers need these same competencies, but they also need skills to adapt general curriculum content and teach to state standards. Teachers need to take courses in general curriculum content or need to learn how to teach general curriculum content within current course work. To make room for this, some things may need to be condensed. In our program at UNC Charlotte, for example, we replaced the curriculum course with a course on curriculum adaptations where we teach students about the standards in reading, math, and science, and how to make these curricular modifications or adaptations.

Diane: What are some of the kind of skills teachers will need in today's world?

Fred: Teachers need training in the general curriculum content and need the skills to collaborate with general education teachers on content and how to extend state standards. Even if Alternate Assessment goes away tomorrow- the priority is not going to go away because parents, teachers, and researchers have seen the data that these students can learn academic content.

Diane: When we did our validation study, teachers liked the examples of the academic content we shared and said they could teach them, but our IHE faculty was not so sure these were teachable. Why do you think that might have occurred?

Fred: Faculty also needs to build capacity in content area instruction although we probably will do it in different ways by reading research and going to national conferences. One of the reasons faculty may hesitate is because the research has been sparse on teaching academic content beyond sight words, money, and in science there has been almost nothing. New research is now emerging that I think in time will build the evidence base. I believe that some of the work in which we have been engaged (e.g., alternate assessment, alignment, teaching academic content) is starting to extend the conversation.

Diane: As you and I have collaborated on some of this research, we found we needed to do some thinking about the conceptual foundations for it…to answer the questions, "Why teach science to students with significant cognitive disabilities?" Or, "Why teach math?"

Diane: A set of resources we would like to share today are brief conceptual statements written for each content area. These are meant to help states and teachers think about what is most important for students with significant cognitive disabilities. We still need IEP planning teams making the specific decisions for individual students, but for statewide planning and even for the individual level planning, we need some guideposts for knowing what we are trying to achieve. Information on how these statements were validated with content experts, special education experts, and teachers can be found on our web site.

Let me pause here to identify that this is the Curriculum Summit conducted in partnership with NCEO, NAAC, and UNC Charlotte.

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English/Language Arts (ELA)

Diane (ELA - Conceptual Model): Let's look at one of these models (ELA Conceptual model Statement). In this model, we have divided language arts into reading, writing, research and communication. Each of these can be divided further as shown in the conceptual model. The priority for all of these strands is producing and accessing text communication for quality of life. Bob, why producing and accessing text as the focal point for setting priorities… why not just developing a communication system?

Bob: Communication is important and most experts would agree that language arts is mainly focused on the communication skills of reading, writing, listening and speaking, mainly in areas like comprehension, vocabulary, critical thinking, writing for meaning, etc. But it is important to differentiate between communications and communications systems. The way that I see it when we talk about communications systems, we're talking about the "how" of communication. In ELA, when we talk about communications, we're talking more about the "what" that is being learned. Students need to acquire skills and expertise across the grade levels. As a parent of a child with autism, I am especially concerned that language arts will ONLY be perceived as a communication system. But it goes WAY beyond that. While acquiring symbols to communicate during daily routines is important, it's also important that all students have the opportunity for a full language arts curriculum with a priority on learning to read, if at all possible.

Diane: So as both a researcher and parent, you would stress the need for all students to be taught to read and write…and if they cannot read or write, they should be taught to produce and access text in other ways.

Bob: Absolutely. We wouldn't consider a typical student as being proficient in ELA if they could talk, which is certainly an effective communication system for many. So why settle for less for kids with disabilities?

Diane (to Maryann): Maryann, why is accessing and producing text so prominent in this proposed model for setting priorities?

Maryann: Our model focuses on the importance of not only decoding text, but also on comprehending text. The progress depicted in the model moves from a literal level of comprehension, where students grasp what the author stated in the text, to deeper levels of comprehension, such as the interpretive and applied levels. Through this progression, students can move from simply decoding the symbols on the page, to obtaining meaning from text, and then generating meaning through their own responses.

Diane: In our model and the conceptual statement, we emphasize shared literature. What is a literature based model and how important is it within language arts education?

Maryann: A literature-based model emphasizes the use of authentic texts, both narrative and expository; in other words, it emphasizes the reading of real texts for real purposes. The literature-based model values both the skills students need to use when reading, such as knowledge of phonemic awareness and phonics, as well as the application of those skills for authentic purposes.

Diane: An interesting thing we found when we first focused on research on literacy is that very few teachers were using a novel or any other book. In this shared literature approach, a critical component of language arts instruction will be making grade and age appropriate books and other text accessible to learners. Maryann, how do both narrative and informational/ expository text relate to this priority?

Maryann: It is important for students to apply the skills they have learned as a foundation for reading to texts across content areas. Content area texts, such as those used to teach subject area material, come in the form of both narrative and expository. Using a literature-base model of reading instruction can help to expose students to variety of text forms and it can help them to learn strategies for comprehending different types of content area materials.

Diane: So by making understanding text the priority, students gain skills that are usable across content areas and across a lifetime. As we look at our conceptual model and strands of language arts, those who know curriculum in this area may ask about their source. There are no national standards in language arts, correct Bob?

Bob: Correct, but all states have created ELA standards and so divide the content into some type of logical units. There is general agreement among experts that certain strands are important, such as phonics, phonemic awareness, vocabulary, comprehension, writing, reading for enjoyment, etc. For our model, we used the strands that North Carolina uses which are similar to the strands used in many other states. But you are correct that in reading/language arts, there is no national set of standards, such as you might find with the NCTM standards in mathematics.

Diane: Sometimes in looking at instruction and alternate assessments, we find entire strands omitted. What is the downfall of leaving out a whole strand …for example deciding that research is not a priority for this population?

Bob: Research is a critical skill for students, especially in 21st century schools. Students must be prepared to be able to locate information in a world where information exists in many forms that go well beyond traditional texts. In fact, in my field of literacy education, we are now talking about "new literacies" which go beyond reading from a book – using the Internet, text messaging, interacting with video games, participating in online social networks, etc. We differentiate this from "traditional literacies," which we would define as mostly reading from print material. For example, many students, from pre-schoolers to graduate students, rely on the Internet as a way to search for meaningful information. Students with disabilities need to know how to access information – how to use a search engine and input meaningful keyword searches that aren't too broad or too narrow, so that you don't get too many hits or too few hits.

Diane: So it sounds like you feel that all students (even students with significant cognitive disabilities) should be able to find information through research?

Bob: Absolutely**!** My son, who has severe autism and is not conversational, can do a Google search to locate his favorite videos on You-tube and other Internet sites. Even if it isn't assessed, it should be taught. For him, the motivation to find the videos was critical to his learning to use the Internet. Today he is surfing the net for an hour or two each day. We actually did not set out intentionally to teach him this. As a matter of fact, I was looking on Amazon for new videos that he didn't have as possible Christmas presents, and I saw that he was very interested in clicking on the pictures of the videos and reading the titles of the episodes. After I left the computer, I saw him log into the Internet and go back to Amazon, which just blew me away. I helped him fine tune his search sites and showed him other options. Of course, this is a little different from what we would expect students to be doing in schools, but I think the same rules apply. Without these research skills, his access to information would be severely limited. Most people are shocked to watch him surf the net, since they assume that someone with such severe disabilities shouldn't be able to do that!

Diane (to Maryann): One of the outcomes we found on doing alignment studies is that states focus on reading. Can you talk about that situation - making reading the priority? Is that the same in general education?

Maryann: Very much so, because reading is vital for understanding all subjects. It is at the core of the general education curriculum.

Diane: We know from research that students with significant cognitive disabilities have historically lacked opportunities to learn to reach. In this model, the circle "independence as a reader" and the conceptual statement emphasize that every child should have the opportunity to learn to read.

Maryann: Reading isn't an isolated skill that is mastered in the early or elementary grades and then set aside. Contrary to a popular cliché, students do not "learn to read, and then read to learn." They continue to learn strategies throughout their school years, and hopefully beyond their school years, that will help them to comprehend increasing complex texts across subject areas.

Diane: We have had some interesting outcomes in Project RAISE here at UNC Charlotte where students *are* becoming independent readers…students who surprise us because they began with challenges like being nonverbal and having limited communication systems. But some students, even with intensive instruction, may not learn to read. Or their reading skills may not be advanced enough to manage more advanced content. One option we have taught is for students to participate in a read aloud to gain meaning. During our validation study, one respondent wondered about using read alouds with older students.

Bob: In assessing students in reading, using something like an informal reading inventory, we look for a student's listening comprehension level as well as their reading comprehension level. For most students, they are different. In other words, many students can understand information at higher grade levels than they can understand the same information if they read it on their own. We believe that for many students, decoding the words might actually compete with their ability to focus on understanding the text; the less someone has to rely on processing or decoding the words, the more cognitive capacity they have left over to focus on the meaning. For instance, when I taught ninth grade English, I had to teach my students, who generally read at around the second or third grade level, Romeo and Juliet, since it was in our state standards. There is no way they could have understood the original Shakespeare play. But we watched part of the movie and had rich discussions about the themes in the play. One student even remarked, "They should have listened to their parents. Why would someone that young want to get married in the first place? They deserved what they got!" So these students clearly could not read the text, but they understood the plot and the related themes in the play. If I had asked them to read the text and expected a subsequent discussion, it just wouldn't have happened. I think that this could be considered an alternate achievement standard, especially if the processing of words was not being assessed but accessing the literature was being assessed.

Diane: So the take away message in language arts is that, "It's about the meaning of text." I also like to tell teachers, "Don't forget the book."

Diane: Let's move on to a discussion of math, but before we do…let me just pause to identify this as the Curriculum Summit. I am Diane Browder here with a team of educators from UNC Charlotte. Next I'll be talking with math educator and researcher Dave Pugalee.

Math

Diane: Now let's take a look at the conceptual model for math. We see in our visual schemata the strands and processes of math: number and concepts, data analysis and statistics, algebra, geometry, and measurement are the five content strands; problem solving, connections, representation, communication, and reasoning are the five process strands, but the word "problem" is prominent. Our big idea is that, "It's about the problem." Why is the problem the focal point for setting priorities, Dave?

Dave: Essence of the meaning a procedural understanding versus a conceptual understanding. Problem solving is the heart of mathematics, and the problem provides a tool for making sure students understand the mathematics that they are using.

Diane: It seems ironic that we would take what some find the most intimidating part of mathematics, the "word problem" and make that our focal point. Why use word problems in mathematics?

Dave: Real life stories actually make mathematics more accessible versus focusing on naked computation problems without context. It engages students with the mathematics and gives a way of understanding how math is a life skill we use every day in a life context.

Diane: So you are saying using stories that are culturally relevant and authentic to the everyday lives of students is not just good instruction for students with special needs, but for all students?

Dave: Motivation is important to keep them engaged. Using stories in math is a good way to engage students and develops their process skills. The story is a mechanism to reinforce the content. It is imperative that students are engaged in building mathematical knowledge. What better way to engage them than to use stories than to use stories?

Diane: When we first came to you to say we had made some progress in understanding language arts and were ready to tackle math, we showed you the adapted novels we were using. My big "aha" moment was when you advised us to build on these literacy skills as a way of approaching math, or to take a literacy approach when teaching math.

Dave: For math education in general, there is recognition that we have failed to make the language connection. Students must be able to understand contexts for problems. Teachers who use story-based approaches are helping students develop skills that allow them to 'interpret' applications and situations within a mathematical context.

Diane: I like to tell teachers that the "formula" for creating a math lesson is a story plus a task analysis for how to perform the math operation with a graphic organizer and manipulatives to compensate for any missing numeracy skills. The tricky part is to ask whether or not the student is still doing mathematics. Let me give you an example, we are trying to teach students to compare fractions…the lesson you and I looked at a few weeks ago together…Many students will need manipulatives like circles with fractional slices and maybe real objects like pizzas or liquid measuring cups. Some students may not really understand numbers yet and so for them, they will need to use matching to derive the answers. At what point does it cease being mathematics and become a cooking lesson or something else?

Dave: To be mathematics, and specifically the skill of comparing fractions, students will need to understand the nature of fractions and the part/whole relationship. There obviously are different depths of knowledge for doing this which can be as simple as lining up the templates to derive the answer or as complex as using ratios and proportions to solve problems and make conversions. But if students do not compare and select the correct fraction, if they only enjoy the pizza, the math is lost.

Diane: In math there are National Standards. How do they influence State Standards?

Dave: Yes. States model their work after national standards. The National Council of Teachers of Mathematics (NCTM) has definitely influenced our mathematics curriculum. States align their own frameworks to the NCTM standards. They will have all five of the strands represented in different ways. For example, NC combines geometry and measurement but there is definitely a clear alignment to the Standards. This is important in providing students common ideas and concepts regardless of which state they live. The National Assessment of Educational Progress (NAEP) also parallels the content and process strands of the NCTM Standards.

Diane: In trying to set priorities, do you recommend prioritizing in each content area? What happens if you decide to leave out an entire strand (e.g., algebra)?

Dave: I think all students need access to the general curriculum. What happens when we leave something out is that students develop a fragmented knowledge base and struggle with making connections. Mathematics isn't compartmentalized into the five content and process strands without any interactivity. There are numerous connections between and among ideas and concepts in the strands. If students are not given the full opportunity to study each strand, it is inevitable that huge gaps will sooner or later emerge.

Diane: We need to be very creative in how to identify the most essential content. In working with you we have developed studies on teaching linear equations and teaching points on a plane in geometry. An instructional challenge often experienced is planning for the diversity within this population. To try to meet this challenge, we created a process called, "Work it across." I would like to look at one together.

For those participating in the call, this resource is available on the website http://education.uncc.edu/access/ under Curriculum Summit. This is Diane Browder with a panel of UNC Charlotte faculty discussing curriculum access for students with significant cognitive disabilities.

So in this example, the expectation for grade level achievement is for students to investigate and summarize outcomes from simple survey research. We have planned for students at an abstract symbolic, concrete symbolic, and beginning symbolic level. Students at an abstract level would be generating answers, those at a concrete level would be making choices between pictures or symbols, and students learning symbols concurrently with the content would be using concrete manipulatives to make choices.

What we are trying to do is retain the content centrality. Dave, can you comment on what the boundaries are for this content. When would it no longer be data analysis?

Dave: I like to think of 'entry points' for the learning targets or goals. Students will have different levels at which they can demonstrate understanding. The level of complexity will depend on the student's prior successes with the concept. Collecting information and putting it into a chart or graph, while signifying basic mathematical skills, has the potential to be a dead-end street for building mathematical understanding. I would think at the fifth grade level, the display of data wouldn't be the objective of this standard; the emphasis would be on summarizing the data. The ways that students use the data to summarize or predict is the underlying mathematical objective. Can students use the chart/graph – that is are students showing an understanding of the data as communicated in the standard? The types of questions might be different – but if we push the limits of the students then they can make some decisions and conclusions based on the data - that is they can demonstrate that they know how two variables are related and how changes in one affects the other. We can get at this in multiple ways, but the emphasis for this standard has to be the relationship between the variables and how the chart/graph provides a tool to show the information and then use that tool to make summaries or predictions.

Example of Work it Across for a Math Standard

Standard: *Mathematics Standard 6. The student will demonstrate through the mathematical processes an understanding of the relationships between two variables within one population or sample.*

Essence of the Standard (Expanded Standard): *Collect information and summarize in chart/ graph*.

Grade Level

5th Grade	On Grade Level Expectation (Not adapted)	Abstract Symbolic	Concrete Symbolic	Beginning Symbol Use
Teaching Activity	Students have projects to design investigation & summarize outcome (simple survey research)	Create and implement a survey; summarize outcome using choice of plot or bar graph	Make choices to help in creating and implementing survey (e.g., who to survey, what to ask); administer (may use AT); choose between picture or symbol graph	Make choices to help create survey; use AT to help administer questions; summarize each response as received using choice of picture or symbol
How Student Shows Mastery	Design a mathematical investigation and analyze data using mathematical computations.	Compose overall survey questions. Uses words and/or symbols to create survey questions (e.g., who, what when, etc); use graph of choice to answer prediction and comparison questions.	Uses selection response to identify 3 or more key survey questions; administer with AT; tally responses onto bar graph (or other format) use graph to indicate which is more/less.	Use selection to make at least one choice about survey (e.g., who- boys or girls); administer by independently activating AT or passing out paper; summarize response as received using concrete manipulatives (e.g., object graph); place "more" symbol on appropriate column of graph.

Diane (to Fred): Sometimes alignment feels like a balancing act…we balance getting the content centrality correct, but we also balance making the skill have meaning for students with significant cognitive disabilities. Some might ask, "Why try? Why not just stick with purely functional skills, those like money and measurement?" Fred Spooner, an expert in severe disabilities, is here with us today. Fred, why not just focus on the strands of math that are functional - the ones we always taught before?

Fred: We DO need to keep teaching functional math like counting money and measurement, but we also need to give students full educational opportunities in mathematics and all general education curriculum content. This is exemplified in an idea from Donnellan (1984) about the least dangerous assumption. The idea from Donnellan (1984) of least dangerous assumption suggests that in the absence of conclusive data, educational decisions should be based on assumptions which, if incorrect, have the least dangerous effect on the student. Additionally, there are legal requirements. NCLB (2002) suggests that the content needs to be academic (i.e., reading math, and science). Even if the law changes, parents and students have experienced higher expectations, and they not going back; our history suggests that once a door is open to access for students with severe disabilities, we don't close it.

Most recently, in our review on research to teach mathematics to this population (Browder, Spooner, Ahlgrim-Delzell, Harris, & Wakeman, 2008) we found: 68 experiments. Practically ***ALL*** of these studies related to teaching skills from two standards (Numbers and Operations and Measurement) with most of them teaching money skills like the "one more than" strategy.

Science

Diane: Thanks Fred and Dave. I'm Diane Browder hosting today's Curriculum Summit with a panel of faculty from UNC Charlotte with whom we have worked closely on alignment to state standards. Next I'd like to talk with Warren DiBiase, science educator, about our model for science.

Diane: Below what looks like an eye, are circles showing the various strands of science content. Six are below the eye, but the seventh, inquiry, is made prominent in our visual diagram and in our conceptual statement. Why is inquiry so important in science education?

Warren: Inquiry is both an instructional strategy and the process by which science is done. Inquiry is the instructional strategy advocated by the National Science Education Standards. When students learn science by inquiry, they are actually doing science, paralleling the work of real scientists.

Diane: During our validation study, one science expert said that they liked our model because it avoided the pitfall of teaching science like a foreign language. What does that mean - teaching science like a foreign language?

Warren: All too often, science is taught as a foreign language, where students memorize vocabulary words. They read, memorize, and regurgitate science vocabulary words and discrete scientific facts without having a conceptual understanding of the scientific concept or principal. For example, let me share a story from my own early teaching experience, before I transformed my own teaching to inquiry. One of the topics that I taught in my chemistry class was density. The students read about density in the text book and memorized the formula - density is equal to mass divided by volume. They even did density problems, getting two of the variables and solving for the third. I was in graduate school, learning about inquiry and beginning to question my instructional practices. I gave the students the following scenario, "Let's say that you go home tonight and hack saw off a 3 inch high piece of your parent's aluminum storm door. How would you find its density?" The students replied, "Mass divided by volume." I then asked, "Well, let's assume that you go home the following night and hack saw off a piece of you parent's aluminum storm door 8 inches high? How would you find the density of this piece?" The students again replied, "Mass divided by volume." I then asked them, "Which piece is denser?" In unison, they paused and said, "The bigger piece." What I learned from this experience is that they did not understand the concept of density; instead, they had memorized a formula and 'plugged and chugged' the answer in an equation.

Diane: Let me play devil's advocate for a minute. Many students with significant cognitive disabilities don't know the words or have the symbols in their communication systems for the science concepts to be learned. For these students to acquire the symbols and words of science concepts, we may have to do some massed trial instruction with systematic prompting in feedback. For example, we may have drill the sight words condensation and precipitation before students can use them to identify what process has occurred. Are you saying that is not good science instruction?

Warren: It is not necessarily 'bad' science instruction, it just not as effective as using inquiry. In plain drill with sight words, the students have no context in which to make meaning of the word. The research tells us that it is far more effective to give them a learning experience where they experience the phenomenon and then get introduced to the vocabulary word. In this way the word is contextualized. For example, show them pictures of various forms of precipitation and then introduce the word precipitation.

Diane: What exactly is inquiry?

Warren: Inquiry is a set of interrelated processes by which scientists and students pose questions about the natural world and investigate phenomena. In doing so, students acquire knowledge and develop a rich understanding of concepts, principles, models, and theories. The process of inquiry is not a uniform series of predetermined steps. Instead, students follow innumerable paths in seeking new knowledge about natural and human made phenomena. Nevertheless, certain patterns in the methods of successful scientists are evident in students during inquiry. For example, in their capacity to recognize problems, ask relevant questions, formulate working hypotheses, figure out the best way to observe phenomena, handle data with accuracy, reach tentative conclusions consistent with what is known, and express themselves clearly about the significance of findings.

Diane: The big idea in our model, “It’s about the question.” We haven’t taught our students to ask questions in the field of severe disabilities.

Warren: In many respects, students do not know how to ask questions; they are too used to being spoon fed discrete bits of information and being asked to memorize them.

Diane: Wonder, marvel, appreciate are words that appear in our conceptual model/statement - some of our experts in special education trained in applied behavior analysis question the use of these words as not measurable or accurate. Scientists are known for focusing on measurable phenomena and precision, so why do resources on science education often use words like marvel and wonder? What do these words mean to science educators?

Warren: It is asking questions or critically looking at the world. In many respects it has to do with a sense of wonder about the world and our place in it. We want our students to become critical observers, to ask questions and seek answers to these questions. It is an appreciation of nature and all it involves.

Diane: So we could define wonder as observing and posing questions. One of the joys in collaborating together is that we have been able to bridge the different pedagogies of our disciplines. As you know, we utilize applied behavior analysis to guide instruction, so will define specific responses to teach directly. Many science educators are more constructivists and focus on students deriving answers. You’ve seen how we took the idea of inquiry and turned it into a task analysis to be taught step by step. Is it still inquiry to you? And are we still doing science?

Warren: Inquiry occurs on a continuum. On one end is open-ended inquiry. On the other end is guided practice. In guided practice, the students are still doing inquiry. Despite the fact that they are doing a task analysis it can still qualify as inquiry as long as they are asking questions, making observations, gathering data and using their observations and data to construct meaning.

Diane: In crossing the bridge to learn more about science education, we have realized that there is benefit in promoting self direction. Inquiry is a process where students use trial and error to learn about a phenomenon… it’s not just teachers defining the process. It’s not all errorless learning. It’s been fun for me to see the kind of guesses our students make after an experiment to explain why something occurred.

Warren: One of the mistakes students in science make is that they always have to get a right answer. It's okay to be wrong and to learn from that guess. Once again, although the answer is important, it is more about the process of deriving your answer. In this process, students use their prior knowledge and their observations to answer a question. This process can be very rewarding for both the teacher and the student.

Diane: Sometimes I get asked about the student with the most significant and complex disabilities…the one who makes no consistent, observable, response…who may not seem to have intentionality of communication but may cry when uncomfortable or vocalize for unknown reasons. Sometimes audiences ask me, "Why teach a student with like this science concepts like condensation or fossils?" I think we make the least dangerous assumption that students may understand the instruction. Until students have means through technology or other options to show what they know, it is dangerous to assume they don't understand. But I do think we need to target active student responses for students to show what they know…by eye gazing to select an option or hitting a switch or touching an object with no teacher assistance. Simply to have students present during the science lesson or guiding their hands through every response is not teaching…in fact Raggedy Andy would do well in that type of lesson. At the very least, students are receiving wonderful sensory stimulation through the many materials introduced in science lessons. Fred, do you have some thoughts about this?

Fred: I agree that we don't know what science students will learn until we teach science. And science can be related to personal interests and survival skills like understanding the danger of mixing chemicals. For example, the science content that is taught needs to come from the National Science Education Standards developed by the National Research Council (1996). There are 7 standards, one of which is *Science in Personal and Social Perspectives*. This standard includes skills like safety. As a field, we've been teaching safety skills to students with severe disabilities since the mid 1980a. These skills are chronologically age appropriate, they now count as SCIENCE, and they are also functional.

Summary

Diane: As we begin to wrap up our call, I would like to ask you a question from our years of working together. What have you learned through our collaboration? For me, it was the introduction to the national work on curriculum like the National Science Foundation, National Council for Teachers of Mathematics, and National Reading Panel.

Warren: For me, I began to understand what you were trying to do when I got the opportunity to talk with the teachers, hear about their students, and begin to understand the constraints they faced. I learned a lot about the population of students with significant cognitive disabilities that I didn't know.

Maryann: As a general education point of view, it has been interesting to see the variety of techniques you use to meet the needs of the students, and you are still able to focus on the content.

Dave: The math stories have been rich in math content. It's been interesting to see how you took the idea of the literacy approach and made easy to understand stories with picture symbols that could be understood by the students.

Fred: I think alternate assessments are rewriting history for students with severe disabilities. Having been in the field for over 25 years, it is only since the requirement IDEA 1997 and it's reauthorization in 2004 that there has been a requirement for ALL STUDENTS to have access to general curriculum. It was an exciting and new idea in the late 1970s when we shifted to a functional curriculum and first tried teaching skills in community settings. That's still important. What's exciting in 2009 is that students may acquire academics and higher order thinking skills to go further in those contexts than we ever thought possible.

Diane: Thanks to everyone. We now invite questions from our callers.

References

Browder, D. M., Spooner, F., Ahlgrim-Delzell, L., Harris, A., & Wakeman, S. (2008). A meta-analysis on teaching mathematics to students with significant cognitive disabilities. *Exceptional Children*, *74*, 407-432.

Donnellan, A. (1984). The criterion of the least dangerous assumption. *Behavioral Disorders*, *9*, 141-150.

Individuals with Disabilities Education Improvement Act Amendments of 1997, PL 105--17, 20 U.S. C. §§1400 *et seq.*

Individuals with Disabilities Education Improvement Act of 2004, PL 108--466, 20 U.S.C. §1400, H. R. 1350.

National Research Council, (1996). *National science education standards*. Washington, DC: National Academy Press.

No Child Left Behind Act of 2001, Pub. L. No. 107--110, 115 Stat. 1425 (2002).