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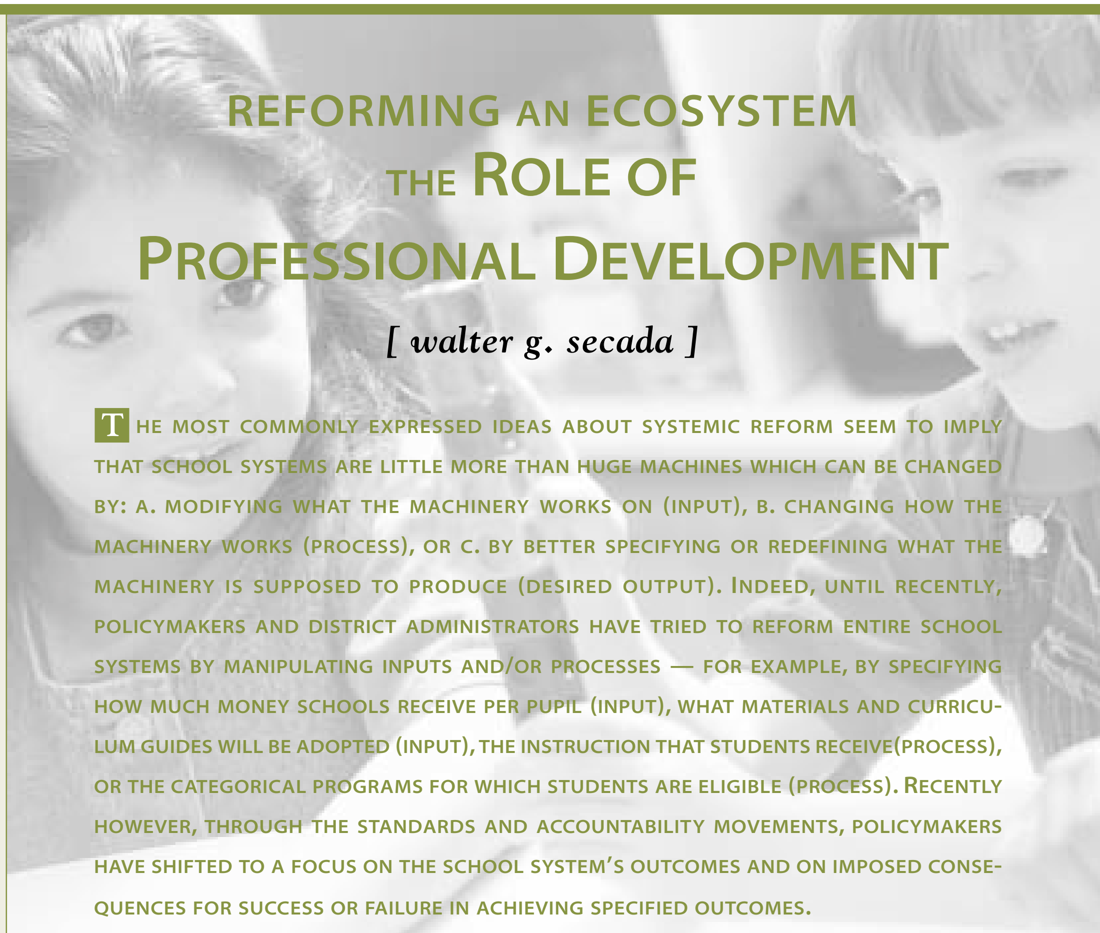

REFORMING AN ECOSYSTEM THE ROLE OF PROFESSIONAL DEVELOPMENT

[walter g. secada]

THE MOST COMMONLY EXPRESSED IDEAS ABOUT SYSTEMIC REFORM SEEM TO IMPLY THAT SCHOOL SYSTEMS ARE LITTLE MORE THAN HUGE MACHINES WHICH CAN BE CHANGED BY: A. MODIFYING WHAT THE MACHINERY WORKS ON (INPUT), B. CHANGING HOW THE MACHINERY WORKS (PROCESS), OR C. BY BETTER SPECIFYING OR REDEFINING WHAT THE MACHINERY IS SUPPOSED TO PRODUCE (DESIRED OUTPUT). INDEED, UNTIL RECENTLY, POLICYMAKERS AND DISTRICT ADMINISTRATORS HAVE TRIED TO REFORM ENTIRE SCHOOL SYSTEMS BY MANIPULATING INPUTS AND/OR PROCESSES — FOR EXAMPLE, BY SPECIFYING HOW MUCH MONEY SCHOOLS RECEIVE PER PUPIL (INPUT), WHAT MATERIALS AND CURRICULUM GUIDES WILL BE ADOPTED (INPUT), THE INSTRUCTION THAT STUDENTS RECEIVE(PROCESS), OR THE CATEGORICAL PROGRAMS FOR WHICH STUDENTS ARE ELIGIBLE (PROCESS). RECENTLY HOWEVER, THROUGH THE STANDARDS AND ACCOUNTABILITY MOVEMENTS, POLICYMAKERS HAVE SHIFTED TO A FOCUS ON THE SCHOOL SYSTEM'S OUTCOMES AND ON IMPOSED CONSEQUENCES FOR SUCCESS OR FAILURE IN ACHIEVING SPECIFIED OUTCOMES.

More-complex ideas about school systems seem to suggest that school systems are like huge Rube Goldberg machines. That is, school systems are thought to operate as loosely coupled machines in which there is slippage between levels of interest. One set of outcomes serves as input for multiple other processes, and things work in complex and somewhat mysterious ways. Almost like magic, the product pops out at the end of a long, convoluted process. A Rube Goldberg machine may be complex, but it is a machine nonetheless.

How can professional development drive, or even support, the reform of a system so conceived? If school systems are machines, then it would seem that professional development faces the choice of working on one piece of the system at a time (inputs, processes, or outputs) or of trying to change the entire system at once. These choices capture the stereotypical dichotomy between providing professional development (usually in the form of workshops or conferences) to many teachers — either in rapid succession or all at once — versus working with a few teachers in great depth. In the latter case, when one is finished working with those few teachers, it is time to move on.

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CGI FROM THE BEGINNING

AN INTERVIEW WITH PROFESSOR ELIZABETH FENNEMA

[sherian e. foster]

Elizabeth Fennema is Professor Emeritus in the School of Education and Director of the Spencer Research Training Grant. In the seventies and early eighties, the research of professor Fennema and her colleagues contributed important information about gender equity in mathematics. Here she talks about the foundational Cognitively Guided Instruction research and the importance of that work.

PROFESSOR FENNEMA EXPLAINED THAT, IN THE MID 1980S, IN SPITE OF ALL THAT WAS KNOWN ABOUT GENDER INEQUITIES IN MATHEMATICS, "EVERY INTERVENTION WE HAD TRIED [TO REDUCE THE ACHIEVEMENT GAP BETWEEN BOYS AND GIRLS] WAS NOT PARTICULARLY SUCCESSFUL." PROFESSOR FENNEMA SAID THAT SHE AND PENELOPE PETERSON HAD WORKED TOGETHER DOING RESEARCH ON TEACHING AND THAT SHE AND THOMAS CARPENTER HAD TALKED "FOR MANY, MANY YEARS ABOUT THE IMPORTANCE OF RESEARCH ON LEARNING." (SEE SUGGESTED READING.) "BUT," SHE SAID, "WE HAVE HAD DECADES AND DECADES OF RESEARCH ON LEARNING THAT HAS NOT MADE MUCH OF AN IMPACT ON WHAT GOES ON IN THE SCHOOLS." FENNEMA, CARPENTER, AND PETERSON, THEREFORE, DECIDED TO "TRY TO INTEGRATE THIS STUDY OF TEACHING ALONG WITH THE STUDY OF LEARNING." THEIR DESIRE, ULTIMATELY, WAS TO EFFECT REAL CHANGE IN THE CLASSROOM AND TO ENHANCE MATHEMATICS LEARNING AND ACHIEVEMENT FOR STUDENTS.

THE ORIGINAL PLAN

Professor Fennema explained: "The overall purpose of CGI, originally, was to do a three-year research project in which we would study the *impact on teachers of their learning about what we knew from research about children's learning and thinking in mathematics.* It was not enough to just study the teaching. We also wanted to study the *impact on learning* of the children in these teachers' classrooms. . . ."

"This went along about as expected for the first couple of years. We had long, involved discussions about how we would help teachers learn about children's learning and what we would tell teachers to do — because almost all curriculum development projects try to tell teachers what to do with information. And that's what we planned to do. We planned to develop some kind of a curriculum based on what we knew about children's thinking, teach it to teachers, and assume they would do what we had told them to do — and that would be it."

A CHANGE IN PLANS

Professor Fennema continued, "But along about the first six months of the project we realized that [telling teachers what to do with knowledge we gave them] was basically in conflict with what we knew about learning and what we knew about teachers." She pointed out that "the fundamental assumption underlying CGI is that you have to make instructional decisions based upon each child's thinking" and added, "It would have been a little bit arrogant of us to think that, before we knew the children, we could tell the teachers what to do in the classroom!"

Professor Fennema said that the principal investigators "realized that, indeed, we did *not* know what teachers should do with this material. It had never been tried before." She continued: *"We decided, as a result — upon really examining our own knowledge of teaching and learning — that the only thing we could do was to help teachers learn about how children learn and then to study what they did with that knowledge."*

"It turned out to be the best decision we ever made, to be very truthful with you. Teachers have so much knowledge about the practicalities of teaching and about children that they were much better able to implement something than if we had told them what to do."

AMAZING CLASSROOMS

Professor Fennema explained that the principal investigators did not go into the classrooms because "it would have really influenced the results of the study." Near the end of the study, however, after the data were collected, Fennema, Carpenter, and Peterson decided that they themselves had to see what was happening in classrooms in which teachers had research-based knowledge about how children think and solve problems.

Professor Fennema said, *"We could not believe our eyes at the quality of the teaching that was going on.* We realized, at that time, that we had a great deal more in our hands than just a research study. We were amazed. . . . "The classrooms that we first saw do not begin to compare with what we see today, but — compared to what we had both seen before in the elementary schools — they were amazing."

CHILDREN LEARN MATHEMATICS

The most important effect of CGI for children, Professor Fennema said, is that they are learning and "taking a different kind of look at mathematics [than they

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Developing a "Dangerous" Pedagogy

Talk Given at the 1999 *CGI* Institute for Teachers

[gloria ladson–billings]

ALTHOUGH I FEEL LIKE MY COLLEAGUES HERE AT UW–MADISON IN MATHEMATICS EDUCATION HAVE ACCEPTED ME AS AN HONORARY MATH EDUCATOR, I DO HAVE A CURRICULUM HOME IN SOCIAL STUDIES. MY TRAINING IN SOCIAL STUDIES PROMPTS ME TO LOOK AT MOST ISSUES THROUGH HISTORICAL, GEOGRAPHIC, SOCIAL, POLITICAL, ECONOMIC, OR CULTURAL LENSES. I EVEN SEE OTHER SUBJECT AREAS THROUGH THOSE SOCIAL STUDIES FILTERS. SO, TONIGHT I WANT TO SHARE WITH YOU WHY I THINK INCORPORATING CGI IN YOUR CLASSROOM IS POTENTIALLY A DANGEROUS PEDAGOGICAL MOVE. MY REMARKS THIS EVENING ARE ENTITLED: "COGNITIVELY GUIDED INSTRUCTION: DEVELOPING A 'DANGEROUS' PEDAGOGY." I THINK THERE ARE AT LEAST FIVE REASONS WHY INCORPORATING CGI INTO YOUR INSTRUCTIONAL PRACTICES REPRESENTS A DANGEROUS PEDAGOGY.

Danger Number 1:
Challenging the Status Quo

First, incorporating CGI is dangerous because it challenges the status quo. *Schools are organized to maintain social and cultural norms. One of those norms is that mathematics is a subject area organized to sift out the best from the rest.* While schools will accept some minimal level of mathematics competence for all students, high level functioning in mathematics seems reserved for an elite few. And, that elite group is restricted to white middle class male students and some Asian American students. Female students, poor and working class students, African American and Latino students, and students who are second language learners often are relegated to a cycle of failure in mathematics.

CGI represents an attempt to interrupt the status quo. This interruption will not sit well with traditional school officials. If everyone can demonstrate greater mathematics understanding, who will be left to fill in the spaces reserved for "basic math," "consumer math," and "math for math phobics?" How will we be able to continue to rank and rate students? How will we know who is "better?" Yes, a serious incorporation of CGI into a classroom is bound to upset the status quo.

Danger Number 2:
Encouraging Students to Think

Second, incorporating CGI into the classroom is dangerous because it encourages students to think. Now that might sound paradoxical, but I argue that schools are not places where we encourage students to think. Indeed, the late James Baldwin, an esteemed novelist and civil rights activist, argued that no society really wants thinking people. Thinking people raise uncomfortable questions. Thinking people ask for explanations to the contradictions that exist between what we say and what we do. Students who are thinking are quick to ask, "How come…?" "How come our school doesn't have enough books for all the kids? How come we don't have any teachers who can speak our language? How come only a few kids from our school graduate from high school?"

The kind of thinking that students are encouraged to do through CGI is the kind of thinking we hope that students will do in every aspect of problem solving they encounter. Mathematical problems are but a few of the problems that students work to solve each day. How can I stop a big kid from picking on me without looking like a wimp? How can I get my homework done, go to soccer practice, and finish all my chores this afternoon? Does it make more sense to continue to play in the orchestra or should I try out for the basketball team?

CGI's oft heard question, "How did you come up with that solution?" provides a criterion that students can and should use for a variety of problems. Of course, our parents were more likely to ask us, "What in the world were you thinking?" but the cognitive demands are equivalent — how do we come up with the solutions to our problems?

Danger Number 3:
Changing the Curriculum

Third, incorporating CGI into the classroom is dangerous because it precipitates a change in the curriculum. Most of the research that has investigated the state of elementary mathematics in the U.S. indicates that our elementary mathematics curriculum is filled with rote learning of low level arithmetic. The mathematics in the elementary curriculum is formulaic. Students are required to learn algorithms and rules for basic operations of addition, subtraction, multiplication, and division. Most students learn how to do those algorithms, follow those rules, and remember rote operations. However, most students do not

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have before]. It gives them the ability to understand that they *can* makes sense of mathematics and that *how* they make sense of mathematics is important."

Kindergarten children in CGI classrooms can, for example, solve a problem such as this:

Our class has 3 pages with stickers on them. There are 4 stickers on each page. How many stickers do we have?

In CGI classes, much attention is given to each student's thinking and problem solving strategies, and multiple strategies are encouraged. Professor Fennema continued: "As [students] communicate their strategies — sometimes quite simple strategies, sometimes very complicated strategies — they begin to feel that mathematics is an understandable body of content, that they, indeed, can learn and that it's important to learn. It somehow makes them feel so good about mathematics and about themselves. Plus, obviously, they learn to do mathematics! *We must never forget that the bottom line is that students learn to do mathematics in a way that we had never really thought that children could."*

TEACHERS ARE PROFESSIONALS

When asked about the most important effect CGI has had on teachers, Professor Fennema said: *"I think the most important thing for CGI for teachers is that they have been given the opportunity and have acquired the knowledge that makes them truly professional. They, by understanding the children's thinking, are able to make decisions that improve learning."*

Professor Fennema said, "I feel strongly about the impact I've seen on teachers who've become truly professional," and she mentioned several important changes they saw in CGI teachers:

- "Certainly they know their children much better."
- "They begin to think a great deal differently about themselves as teachers. They know that the responsibility [for student learning] is theirs — they've always known that — but now they have the knowledge with which to take that responsibility and do something with it."
- " They have changed the way they teach dramatically." Professor Fennema noted that all teachers with whom they have worked changed, albeit to varying degrees.

Professor Fennema is passionate on this point. She reiterated, *"The knowledge of children's thinking is powerful. It's extremely powerful. It's enabling."* With a twinkle in her eye, Professor Fennema recalled teachers who have become national leaders and said, "Tom [Carpenter] calls me a 'born-again cockamamie scientist.' I say, 'Maybe I am!'" She quickly added, with professional sincerity, "But I'm not that kind of researcher."

CHANGING A SYSTEM

When asked what recommendations she would give to a school or district trying to implement CGI, Professor Fennema made several points.

<u>Change will come through teachers' professionalism.</u>

Professor Fennema said she supports the approach that Walter Secada and the Comprehensive Center are taking. She emphasized that schools should "not to go into full-scale implementation the first year." Rather, she said, it is important "to get a core group of teachers that understand it fairly well — and the only way to truly understand [CGI] is to teach it a year or so — then facilitate letting those teachers disseminate it to the rest of the school system." *This is possible, Professor Fennema said, because teachers are professionals who know their schools and know how to implement new things in their own settings.*

Teachers are instrumental in bringing administrators along in their understanding of CGI by involving them in the change, said Professor Fennema, and she gave an example. Some teachers "quite often send a child to the principal's office to explain how they solved a problem." This has several benefits. The child is "feeling extremely important because she solved a difficult problem, and she is going down to tell the principal about how she solved it. It only takes two or three minutes for a child to come in and explain a solution strategy, and principals have an interaction that's pleasant with children. They, also, can see what the children are thinking. *I think that what really hooks teachers is children's thinking — but I think it hooks principals, too."*

Professor Fennema said that she feels having administrators attend CGI workshops is important so they can understand "what CGI really means." That, she said, "means more than just reading about it."

Teachers play a key role in helping parents understand what their children are learning in a CGI mathematics class. Again, Professor Fennema gave an example. One teacher, she said, "would have the children and their parents come to school one night, and everybody solved problems. Then the children would come up in front to the overhead and explain

Schools should not go into full-scale implementation the first year. It is important to get a core group of teachers that understand [CGI] fairly well — and the only way to truly understand it is to teach it a year or so.

[their solutions]. She had to tell the parents, 'Now don't you tell the children how to solve these problems. . . . You sit and see if you can solve them a different way.'" Some teachers "send newsletters home to parents with a solution strategy."

With parents, as with administrators and teachers, it is children's thinking that "hooks them," Professor Fennema said. "Once again — getting the parents intrigued with children's thinking — helping them know that *teaching is not telling* [but is] letting the children have an opportunity to do the exploration on their own." Furthermore, at parent-teacher conferences, "many of the teachers have used the children's thinking in mathematics as a good communication device with parents — rather than talking about some [of the usual] things." Because teachers keep careful track of children's solution strategies, Professor Fennema said, "They can show growth from the beginning of the school year to the end of the school year."

Change takes time.

Implementing CGI involves dramatic changes, Professor Fennema pointed out, but teacher change "doesn't take place in a week, or a month or a year. . . . The *most* growth will take place over a period of several years." She continued, *"one nice thing is that we do see rather immediate growth in children's learning, so they [teachers and schools] can at least be accountable to their parents and to their public that [CGI] is effective."*

Professor Fennema cautioned, however, that "principals often go with something for two or three years, and, if they're not seeing dramatic results, they say, 'well, we are going to try something else.'" But, because change takes time, she advises that "as long as [principals] see growth in their children and their teachers, they should stick with it."

Change requires a joint effort.

With conviction, Professor Fennema said that *implementing CGI and effecting change is " a cooperative venture between the expert on children's thinking and the people who are out on the firing line of teaching, and we both know important things."*

And a Teacher Said. . .

"They must be able to witness success in those classrooms–see the outcome of learning in CGI classrooms verses the non-CGI classrooms. If that doesn't sell a teacher, well, I don't know what else will."

She emphasized that the role of those who lead CGI workshops and the CGI Institutes is to share what they know — research-based information on how children think and learn mathematics.

When asked how they help teachers learn to keep track of every child's thinking or get common planning time, Professor Fennema answered, "*We* don't talk about the details of teaching. *Teachers do*." She continued, "I don't think anybody should trivialize what a complex kind of an activity this is." Teachers and their administrators know best how to solve those problems in their own situations, she said.

NEXT STEPS

Professor Fennema explained that, after the first three-year project, they continued the research — expanding CGI through grade three, exploring "the impact of CGI in schools that were basically made up of African-American children," conducting a three-year longitudinal study in Madison of the impact of CGI, and "trying to put it into pre-service teacher education." She emphasized that "the National Science Foundation . . . has been very, very generous, in their funding of this all the way through."

When asked about the next research to be done, Professor Fennema said that she feels the work Tom Carpenter and his colleagues are undertaking to study children's algebraic reasoning in the early grades will be important. Specifically in terms of CGI, she said she would like to see someone investigate the effects of actively moving students toward using more mature strategies — something CGI, to date, has not encouraged teachers to do.

A PASSION FOR EQUITY

Professor Fennema indicated that the latter suggestion for further research stems from her deep and abiding concern for the mathematics learning and achievement of *all* students in general and her concern for gender equity in particular. She said that girls tend to stay with less-mature modeling strategies, while boys move to more-complex strategies — indicating more mathematical understanding. Also, she pointed out, "girls are not doing as well as we would like to have them do in complex reasoning."

Professor Fennema added, *"I should really emphasize is that girls are doing much, much better than they ever did before.* It's not as if the boys have been the ones who have been learning. Everybody's moved along, but there's still a gap in learning between the girls and the boys and between African-Americans and white, and between Hispanics and white, between Native Americans and white. So we've got to somehow do something there."

As for Professor Fennema, she will not be satisfied until *all* achievement gaps have been closed. She concluded hopefully, saying, *"I think that we have enough information that we can begin to make some intelligent recommendations on interventions and to study those interventions."*

Thank you, Professor Fennema, for your years of dedication and research and for your time in granting this interview.

[about the interviewer]

SHERIAN E. FOSTER is a Mathematics Education Specialist and Editor of this Comprehensive Center – Region VI Newsletter.

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learn what these operations mean. They do not learn how such operations might help them solve the kinds of problems that are important in their lives.

We know that the elementary mathematics curriculum is vacuous, but we aren't sure why the curriculum is vacuous. My hunch is that we permit such a redundant and intellectually weak mathematics curriculum because we know that we do not prepare elementary level teachers well enough in mathematics to be able to answer the kinds of important mathematical problems that children pose.

If a student were to ask how many cats are in her town, would most elementary teachers know how to go about solving that problem or helping the student to solve the problem? These are the kinds of problems that students want answers to. They could care less if Tim has 5 apples and Sue has 4 apples. Most savvy elementary school students probably look at a word problem like that and say to themselves, "can't those idiots tell how many apples they have — and if they can't then maybe they shouldn't even have any apples."

The thinking that students develop in a CGI classroom is not likely to be constrained to mathematics. Its influence may spread to literacy, science, social studies and other subject areas. Students may begin to ask new questions about the nature of all sorts of social and scientific phenomena. This "bleeding" over into other subject fields is exactly what integrated education should be — not the festival of teddy bears or dinosaurs we see in many classrooms.

Instead, the curriculum might be more like that of one of our former graduate students, Barb Brodhagen. Barb and her teaching partner teach in a seventh grade classroom. Each year they begin the school year by asking the students, "What do you want to know about yourself and what do you want to know about the world?" After students individually answer the questions, they meet in small groups to decide which questions the group thinks are worth investigating. Finally, the entire class hears the specific group questions and votes on those questions that most interest them.

One year, one of the questions that most interested the group was "Will I live to be 100 years old?" This one question plunged the students into in-depth studies of actuarial tables, family histories and genealogies, genetic diseases and hereditary chronic conditions. The curriculum lost its rigid boundaries and fixed shape. Some problems evoked by this question prompted the use of mathematics skills. Others required students to use their literacy skills. Still others required the cultivation of research skills. In the end, the students began to exhibit the kind of critical thinking that we might expect from much older students.

Danger Number 4:

Rendering Instruction Unpredictable

Fourth, incorporating CGI into your classroom is dangerous because it makes instruction less predictable. In today's urban classroom, the last thing many teachers and administrators want is unpredictability. So-called well run urban schools are characterized by their strict disciplinary standards, regimentation, and routine. Teachers in such schools are expected to write out daily objectives and ensure that the students pass state and local assessments. The atmosphere in schools like this is oppressive. The emphasis is not on student learning; rather it is on improving the previous year's test scores to minimize the personal sanctions and public critique.

Teachers who incorporate CGI are willing to be less governed by routine and regulation in their teaching. They are likely to be more open and flexible to new ways of teaching because they will experience students' novel ways of thinking. This is not to suggest that CGI teachers do not plan and prepare their mathematics lessons. But, within that planning they are willing to allow student thinking to guide the lessons in a variety of directions, because this divergent thinking eventually will lead to deeper thinking.

In my own research, I have been interested in studying the pedagogical practices of those teachers who are effective with African American students. I want to know what they do to support the learning of those students whom so many others have insisted can't or won't learn. What I have learned from intensive study of such teachers is that effective teaching requires flexibility and variability. Even when teachers establish a routine around which to organize and structure instruction, within that organization there is tremendous variability. One teacher I studied made it a point to begin each morning with a proverb. Although the use of the proverb was standard, what the teacher did with the proverb varied from day to day. Sometimes the teacher used the proverb to connect with students' home experiences. Other times she used the proverb to stimulate word games. Still other times she used the proverb to help the students write their own proverb.

In CGI classrooms I have observed teachers who begin each day with the same routine — doing the attendance and lunch count. However, each day's mathematics lesson is different. One of the teachers I most enjoy watching, regularly engages her students in social justice issues and activism. One year, the students were doing a lot of name calling on the play yard. Instead of merely scolding the students for name calling, the teacher used their behavior as a catalyst for learning. One name that students regularly used was "AIDS Monster." The teacher developed a unit on AIDS that dealt with the disease in an intellectually honest and forthright way. The teacher, trained in CGI, helped the students develop a series of mathematics problems about the spread of the disease, the cost of care, and the amount of money they raised as a result of the red ribbon sale they conducted. She began her work by paying attention to children's thinking about each other and culminated it by directing their thinking toward substantive cognitive tasks.

Danger Number 5:

Creating Dissatisfaction and Professional Power

Finally, CGI is dangerous because it creates a level of dissatisfaction among those teachers who begin to discover the power of children's thinking. This dissatisfaction prompts many teachers to greater levels of professional power. So much of our teacher preparation is focused on what we want students to learn and on how to present information and to develop skills. Now, it would be wrong for me to suggest that there is no place for information and skills. Indeed, we live in what has been called an information age and students need to be able to do something with the all the information that comes to them.

However, what I believe is missing from teacher preparation (and as a consequence, from teaching) is the notion that teaching is about engaging with minds and developing professional power and expertise. Granted, those minds with which you engage may not have mastered the information and skills that you have, but they are minds just the same. Too often, we treat students as if they do not have minds — or at least we treat them as if their minds are not sufficient for the kind of intellectual engagement that we value.

What CGI offers to teachers — and students — is the opportunity to use their minds well. Rather than turn over your mind to a textbook publisher, CGI argues that students already have problems that are inherently more interesting and more challenging. *Teachers who encounter those more interesting and challenging problems, brought to them by students, begin to grow weary of the patronizing, meaningless, pabulum that passes for the curriculum.* They begin to grow weary of notions that only some students are capable of high level functioning in mathematics. They grow weary of the idea that teachers have to be told what to do and are, themselves, incapable of learning.

And a Teacher Said. . .

In a disscussion with non–CGI teachers who were decrying counting with the fingers: "It was like peer pressure, and I realized I had these [CGI] people behind me, so I thought, 'O.K., I don't have to give into this.".

Yes, I think CGI is a dangerous pedagogical practice. It challenges the status quo, it prompts students to think, it precipitates changes in the curriculum, it forces changes in instruction, and it creates a level of dissatisfaction among teachers that allows them to mobilize their professional power and rethink what it means to teach and learn with young students. It is a dangerous pedagogical practice that could fundamentally undermine the way schooling happens in this country. Of course, maybe you think the way schooling occurs in our nation is just fine. I would rather help teachers learn how to do something dangerous.

[about the author]

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A Parent's Experience

Talk Given at the 1998 *CGI* Institute for Teachers

[gloria ladson–billings]

PART OF MY RESPONSIBILITY THIS EVENING IS TO TRY TO SAY SOMETHING ERUDITE AND COMPELLING ABOUT MATHEMATICS EDUCATION, IN GENERAL, AND COGNITIVELY GUIDED INSTRUCTION, IN PARTICULAR. PERHAPS, BEFORE TONIGHT IS OVER I WILL ADDRESS THIS CHARGE. HOWEVER, I AM MOVED TO DO SOMETHING MORE AKIN TO MY OWN AFRICAN AMERICAN RELIGIOUS TRADITION—TO TESTIFY. *TESTIFYIN'* IN THE AFRICAN AMERICAN TRADITION IS IN NO WAY RELATED TO OUR AMERICAN JURISPRUDENCE NOTION OF A COURT APPEARANCE. INSTEAD OF BEING SUMMONED BY A PROSECUTOR TO RESPOND TO A SERIES OF QUESTIONS, TESTIFYIN' IN THE AFRICAN AMERICAN TRADITION IS OFTEN A SPONTANEOUS, SELF-REVELATORY EXPERIENCE IN WHICH THE SPEAKER ATTESTS TO A PERSONAL MIRACLE. BELIEVE IT OR NOT, MY TESTIMONY IS ABOUT CGI.

When my family and I arrived in Madison in 1991, we knew little about its schools, let alone the specific curricular choices. As a teacher educator and researcher I certainly knew of Elizabeth Fennema and her work examining gender and mathematics. I had used some of her work in my own teaching. But I was woefully ignorant about this thing called Cognitively Guided Instruction.

We enrolled our daughter in the neighborhood school the same way many parents do — unaware and trusting. Our experience with first grade was a good one, or so we thought. The teacher focused most of her energy on teaching the children to read. Mathematics was kind of an afterthought. And, knowing of the centrality of reading in the curriculum, we did not worry too much about the absence of mathematics. Of course there was the requisite learning to count, recognition of numerals, and some basic addition and subtraction facts. Since I had never taught first grade, this all seemed appropriate.

At the end of this first year we were happy. We had a daughter who could read well and had some passing knowledge of what we thought was basic mathematics for first graders. For year two, we found ourselves in another school (due to the purchase of a new home). The philosophy of the school was markedly different from the first. Indeed, school number two had a philosophy whereas our previous school was one in which each teacher functioned as an independent contractor. Your child's schooling experience was wholly dependent upon which teacher s/he received.

In the new school, teachers believed in cross-aged grouping and team teaching. The reading program was literature-based and the early grade mathematics instruction was based on CGI. I was excited about what the school year offered, even if I did not know very much about CGI. As a way to support my daughter in her new environment, I chose to volunteer in her classroom one morning a week, whenever I could. Being an eyewitness to the instruction was crucial.

The year did not start off very smoothly. My 7-year-old was unhappy about the change in approach. Instead of being in a small class of 20 students with one teacher, she was in a large class of 43 students with two teachers. She was a second grader and expected to exhibit more maturity than the younger first graders. Her classroom was not arranged into neat rows of individual desks. It had large tables, a big rocking chair, beanbags, and a carpet. I knew things were not getting off to a good start when, before the first week ended, my daughter announced, "I hate this class. We don't do any work. We just have 'activities' and we don't even have our own desks."

I was willing to be patient with the teaching since I know that pedagogy is a complex thing. Its underlying structure is not easily revealed to students, particularly students who are very young. I beseeched my daughter to give her teachers and the classroom a chance.

Tuesday mornings were my time in the classroom. I witnessed the opening exercises where students took responsibility for recording their attendance by placing the Popsicle stick that had their name on it into a container. Each morning the teacher tossed the sticks on to the carpet. As students arrived, they placed their outerwear in their lockers, found the stick with their name on it and put it back into the container, and circled their name on a pre-printed class list if they intended to have hot lunch.

The teacher began the opening activities by reading the names of the remaining Popsicle sticks. Occasionally, someone who was in attendance shouted, "I'm here. I forgot to put my stick in the can." Remember, these were first and second graders and routine often comes slowly. The teacher would then write the names of the absentees on the board and then ask the question, "How many people are here today?" Within a few seconds, a flurry of hands would wave in the air. Many of the children knew the answer, especially the second graders.

I watched uncomfortably as my daughter sat silently with a puzzled expression on her face. As the teacher called on students, she always asked the question, "how did you get your answer?" These little ones would wax eloquently on how they discovered the answer. "I know there are 43 children in our class. Two are absent, so I counted back, 42…41." Similarly, the teacher posed questions about the number of students who were not getting hot lunch. This problem required students to be mindful of how many students were in attendance for the day and who among today's attendees were getting hot lunch. The children shared ingenious strategies for determining how many children were hot versus cold lunch eaters. The entire exercise would have been fascinating to watch were it not for the fact that my daughter regularly sat there clueless.

One day at home, my daughter expressed how frustrated she was with the attendance and lunch-count activity. "I don't know what they're doing," she lamented. "I'm stupid!" At that moment I switched from university professor/researcher to anguished mother. It hurt to see my child hurt. I didn't think of the limited exposure to authentic mathematics in grade one as the culprit. I was upset and angry and went straight for the nearest target. I made an appointment to see the teachers and shared my concerns. They responded in a calm, dispassionate way. "Don't worry," they said. "She'll catch on." And, they proceeded to share the theory underlying their approach. I wasn't hearing it. I didn't want theory. I didn't want research. I wanted a sad 7-year-old to be happy again. However, I tried to be reasonable. "Okay, I'll try to be patient," I said.

And a Teacher Said. . .

"It was a struggle. It was painful for the teacher sometimes, and for the students. But we just kept working through it. I'm not going to give this up. I'm going to keep trying and keep trying. Then, one day, its like a glimmer. They're learning. They're progressing."

Several more weeks passed and nothing seemed to change. Now I was more than a little anxious. My daughter's mathematical confidence seemed to be sinking quickly. I wanted immediate results. I marched into Elizabeth Fennema's office and said, "Look! My daughter is in a CGI class and it's a disaster. She's confused and bewildered and the teachers seem not to be helping her. This stuff doesn't work!" Liz asked who my daughter's teacher was, and, when I told her, she assured me that she was in good hands.

By the end of the year I still was unconvinced of the effectiveness of CGI for my daughter. She seemed to be tentative about mathematics. She still was not participating in the opening problem solving. She worried that she did not complete as many story problems as other second graders or some of the first graders. The teachers seemed to think she was making progress. At the spring conference one of the teachers asked my daughter a complex word problem and placed a tray of Unifix cubes in front of her. Within a few moments my daughter used the cubes to form her response. She and I both seemed a little surprised. The teachers were not.

We nervously began third grade. Sometime near the end of the first semester, I saw a renewed confidence in my daughter. She was whizzing through math problems. One day she asked me a rather mundane question like, "how much is 54 minus 17?" I quickly jotted the numbers on a piece of scrap paper and my 8-year-old said, "You mean you need a piece of paper to answer that question? Can't you tell that 54 is almost 55 and 17 is almost 20? Fifty-five minus 20 is 35. You added one to the 54 and you added 3 to the 17. Subtract one from three and add it to your 35. Now you've got 37." I stared at my daughter with astonishment. She had a strategy! She had command of a mathematical problem without a routine algorithm. I realized that she had benefited from CGI. It just wasn't neatly manifested in the span of a 9-month school year. Instead, she had knowledge she could use. I was happy to knock on Liz Fennema's door with an apology.

Last year my daughter wrote an outstanding bubble gum test report for math, plotted a set of coordinates for photos she downloaded from the EarthKam mounted on the Space Shuttle, and built a computerized land rover for a replicated Mars terrain. This year she enters eighth grade in the accelerated algebra class. She loves mathematics and is good at it. She's CGI success story.

LESSONS LEARNED

While the passion of testifyin' lies in the story itself, the power lies in the lessons learned. What then have I learned from my daughter's CGI experience?

(continued on next page)

The first lesson I learned was not to be casual about an anemic mathematics curriculum. My daughter's first grade experience cheated her out of the kind of foundation she needed to exhibit and improve her problem solving skills. It is not enough for students to learn to count and memorize a set of basic number facts. Don't get me wrong. Children do need to develop number sense. They do need to read and recognize numerals. But, children come to school prepared to engage in problems more sophisticated than "Johnny had 2 apples and Terry had 1 apple. How many did they have in all?"

Just as we would not be satisfied with students only learning to recite the alphabet and form little words such as "see, be, me, and we" by the end of first grade, we must demand a mathematics curriculum worthy of our children's minds. As I think about the CGI curriculum — versus the first grade one — I am reminded of a video tape of a ninth grade algebra class I recently viewed. In it, the teacher wrote "16 divided by 4" on the chalkboard. "What does this mean?" she asked. Quickly several students shouted out "4!" The teacher replied, "I didn't ask you what the answer was. I asked you what the expression means." The room fell silent. Students with a deeper understanding of mathematics would not have been so easily stumped.

Second, I learned that when teachers are confident about what they are doing, they are not intimidated by parental distress. My daughter's second grade teachers did not let my distrust of their mathematics program deter them. They were taking careful notice of my daughter's progress. They were less concerned with right-answer thinking than "right" attitudes toward mathematics. I cannot stress enough how important it is for teachers to know what they are doing. I presume my daughter's teachers' training in CGI helped them to assuage the concerns of nervous-Nellie parents like me. Their ability to see the "big picture" kept them plugging along with a student who seemed overwhelmed by a new approach that asked her to use her mind well.

The calendar is a weak standard by which to judge student learning.

Third, I developed new insights on the artificial and arbitrary ways we have organized teaching and learning in our schools. As a parent, I was dependent on the June end of the school year as the final determiner of what my daughter knew and was able to do. The demonstration of her mathematics learning was showcased as "knowledge in use" when she raised a question with me in the midst of her third grade year. The issue is not what grade she received but what knowledge and understanding she had access to. The calendar is a weak standard by which to judge student learning.

Finally, I learned the lesson of "The Algebra Project's," Bob Moses. That lesson is that mathematics is the new Civil Rights battlefield. In the 1960's Civil Rights Activists understood that poor and disenfranchised people of color needed access to literacy in order to exercise their citizen rights. Throughout the nation's south, civil rights workers fanned out to help people learn to read and write. The Citizenship Schools and the Mississippi Freedom Schools were examples of their efforts. Today, the franchise is guaranteed to all citizens. But, many continue to be locked out of a thriving economy. Their inability to make sense of the mathematical codes ensures that they will have limited opportunities in a highly technological, global economy. As teachers we are obligated to help them obtain this second civil right — mathematical literacy. We are obligated to ensure that they, too, can stand before us to testify!

[about the author]

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ADAPTING WORD PROBLEMS FOR ENGLISH LANGUAGE LEARNERS

[walter g. secada]

Children who are English Language Learners (ELL) can, and do, solve word problems. For example, in a study of first-grade Spanish-speaking ELL students, I found that performance on addition and subtraction word problems was only slightly less than had been found among English-proficient students (Secada, 1991). Ghaleb's (1992) study with a group of Arabic-speaking second graders had similar findings.

Teachers, however, are often unsure of how to work with ELL students in mathematics. With children who all speak the same language, teachers who have the expertise may translate word problems into the language of the children. With a class of students from multiple language groups, simplifying the language — *not the mathematics* — of the problems is helpful.

The following chart, adapted from Secada & Carey (1990), gives some examples. The first column gives the mathematical problem type as classified in CGI (Carpenter & Moser, 1983). The second column gives a CGI problem of each type. The third column gives the Spanish translation of each problem (Secada, 1991). Finally, the last column gives a semantically simplified English version of each problem.

For explanation of the problem types and for more in-depth information about English Language Learners and CGI mathematics, see the references listed below.

Problem Type	*English*	*Spanish*	*Simplified*
Separate, Result Unknown	Julie had 15 pencils, and she gave away 11 of them (pencils). How many pencils does Julie have now?	Julia teniá 15 lápices, y luego regaló 11 de ellos (los lápices). ¿Cuántos lápices tiene ahora Julia?	Julie had 15 pencils. She gave away 11. How many does she have now?
Part-Part-Whole, Whole Unknown	Thomas has 4 blue crayons and 9 red crayons. How many crayons does he (Thomas) have in all (altogether)?	Tomás tiene 4 crayolas de color azul, y 9 rojas. ¿Cuántas crayolas tiene Tomás en total?	Thomas has 4 blues and 9 reds. How many is that in all?
Compare, Difference Unknown	Anne has 11 crayons, and Michael has 15 crayons. How many more crayons does Michael have than Anne?	Ana tiene 11 crayolas, y Miguel tiene 15 (crayolas). ¿Cuántas crayolas más qua Ana tiene Miguel?	Anne has 11 crayons. Michael has 15. Who has more? How many more?
Join, Change Unknown	Paul has 9 balloons. How many more balloons should Paul get in order to have 14 balloons?	Pablo tiene 9 globos. ¿Cuántos globos más debe obtener Pablo para que tenga 14 (globos)?	Paul has 9 balloons. He wants to have 14. How many (more) does he need?
Part-Part-Whole, Part Unknown	Robert has 14 toy cars in all (altogether). Six (6) of them (his toy cars) are blue and the rest are red. How many of Robert's toy cars are red?	Roberto tiene un total de 14 carritos de juguete. Seis (6) de sus carritos son rojos, y el resto son azules. ¿Cuántos de los carritos son azules?	Robert has 14 cars in all. Six are red. The rest are blue. How many are blue?
Join, Start Unknown	Rose had some blocks. She got 5 more (blocks) and now Rose has 13 blocks. How many blocks did she start with?	Rosa teniá algunos bloques. Luego recibió 5 (bloques) más y ahora, Rosa tiene 13 bloques. ¿Cuántos bloques tuvo Rosa al principio?	Rose has some blocks. She got 5 more. Now, she has 13. How many did she start with?
Separate, Start Unknown	Cynthia had some candies. She gave away 6 candies, and now Cynthia has 9. How many candies did she have to start with?	Cindy teniá algunos dulces. Luego regaló 6 de los dulces y ahora tiene 9. ¿Cuántos dulces teniá Cindy al principio?	Cynthia has some candies. She gives away 6. Now she has 9. How many did she start with?

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Cognitively Guided Instruction & Systemic Reform
Native American Pedagogy and CGI

[judith e. hankes]

All six states served by the Comprehensive Center – Region VI have Native American populations. Some teachers of those students have attended CGI Institutes and have successfully implemented Cognitively Guided Instruction. Judith Hankes – herself Native American – actively promotes the use of CGI with Native American students because of the cultural compatibility of CGI principles and Native American pedagogy. She includes CGI in her classes for preservice teachers.

A Comparison of Pedagogical Principles	*Dominant Culture Pedagogy*	*CGI Pedagogy*	*Native American Pedagogy*
Role of Teacher	Teachers generally behave in a didactic manner, disseminating information to students.	Teachers generally behave in an interactive manner, mediating the environment for the student.	The facilitating teacher role promotes cooperative and autonomous learning. Conversational topics are not controlled by individual speakers.
Student to Student Interaction	Students primarily work alone.	Students frequently work in groups and are encouraged to reflect on and discuss their own and other's thinking.	Caretaking patterns of extended families and bonded community interactions are replicated in group learning experiences.
Curriculum	Curriculum activities rely heavily on textbooks and workbooks.	Curricular activities rely heavily on primary sources of data and manipulative materials.	Lessons relate to real problems that will likely confront the student.
Time	The day is partitioned into blocks of time and content coverage. Time on task is considered important.	Class time is spent solving complex problems. Students are encouraged to reflect on and discuss their own and other's thinking. This is often a time consuming process.	Instruction/learning is time-generous rather than time-driven. When an activity should begin is determined by when the activity that precedes it is completed.
Concept Formation	Concepts are presented part-to-whole with emphasis on basic skills.	Concepts are presented whole-to-part with emphasis on big ideas.	All knowledge is relational, presented whole-to-part not part-to-whole. Just as the circle produces harmony, holistic thinking promotes sense-making.
View of Learner	Students are viewed as blank slates onto which information is etched by the teacher.	Students are viewed as thinkers with emerging theories about the world. Students are believed to possess prior knowledge.	Each student possess Creator-given strengths and is born a thinker with a life mission.
Assessment	Student assessment is viewed as separate from teaching and occurs almost entirely through testing. Testing often stratifies students and promotes competition.	Assessment is interwoven with teaching and occurs through questioning and observation of student work. Each student is instructed at her/his appropriate learning level. There is little, if any, use for competition.	Age and ability determine task appropriateness. Learning mastery is demonstrated through performance. Creator ordained mission determines one's role in life, and no one mission is better than another. Competition, situating one as better than another is discouraged.

The chart above is adapted from Dr. Hankes' book: Hankes, Judith E. (1998). *Native American Pedagogy and Cognitive Based Mathematics Instruction*. New York: Garland Press.

[about the author]

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