THE CONSTRUCTIVIST

Magazine of the Association for Constructivist Teaching

Volume 11, Number 1 Summer 1996

ASSOCIATION for CONSTRUCTIVIST TEACHING

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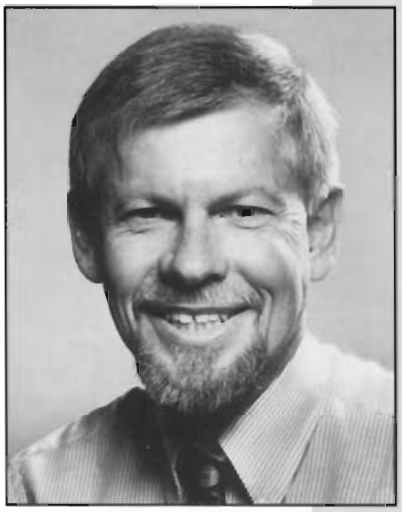
A Letter from the President of the Association for



These are exciting times for me to have the privilege of serving as president of ACT. We are now well on our way to becoming a national organization. In the past few years, our membership has doubled to more than 700. We have held our annual meetings in New York, Alabama, and California (twice), and we will meet this fall in Missouri (November 7–9 in St. Louis). That's a lot of growth for an organization that was still known as the New England Piaget Conference just over ten years ago!

There are, however, some things I hope we can preserve from ACT's earlier days. First, I think it important that we continue to engage the regular participation of K–12 and preschool teachers, and not become the kind of organization that is mainly for "academics" from "higher education" (like me) who have schedules and resources that allow them to travel widely. One way to sustain the involvement of teachers might be for ACT to sponsor regional mini-conferences—one-day events that could include a keynote speaker and a selection of workshops. I urge those readers who would be interested in organizing mini-conferences under the aegis of ACT to contact me at the University of California-Berkeley.

Although Jean Piaget's name has not been a part of our organization for ten years now, I hope that we will continue to draw inspiration and support from his monumental studies of cognitive and social development, and from the work of others who follow in his tradition. In recent years, we have gone through a period of intense questioning, among developmental psychologists and educators, about the validity of Piaget's research findings and theoretical interpretations. But the result, for many, has been renewed appreciation for his legacy. Without denying the relevance of other perspectives, I believe that studies of development in the tradition of Piaget provide an essential foundation for constructivist teaching.

It is exciting, then, that—largely through the efforts of Barry Wadsworth—a new link has been forged between ACT and the Jean Piaget Society, an international society for the study of knowledge and development. The ACT-JPS connection began in spring 1995 when the two organizations held their annual meetings side-by-side in California, and it continues this year with jointly sponsored sessions both at JPS in Philadelphia and at ACT in St. Louis. I hope this is just the beginning of a long-term relationship.

While I am expressing hopes for ACT's future, let me add the hope that we will continue growing not only in numbers but also in the diversity of students and teachers whose needs we address. I sometimes hear people say that

constructivist teaching works only with some students and not with others. In principle, that claim has never made sense to me, because constructivist teaching is based on well founded ideas about *human* knowledge and development. In practice, we need to move away from the idea that "constructivist teaching" refers only to specific methods, and toward the more general understanding that it encompasses any principled way of helping learners construct knowledge. By broadening our conceptions of what constructivist teaching can include, we will deepen our understandings of what constructivism means.

This inaugural issue of *The Constructivist* represents yet another exciting development. We have Cathy Fosnot and Sharon Schattgen to thank for their considerable efforts in getting our new magazine started. Sharon and Brenda Fyfe are also working hard on plans for the November meeting in St. Louis. But the people I have acknowledged here are only a few among many who have made important contributions to the development of ACT. Together, I think we can make ACT an organization that has the kind of leverage it will take to bring about real change for the better in our schools, and in the lives of the students they serve.

I hope to see you in St. Louis.

—Paul Ammon

A Letter from the Executive Editor of *The Constructivist*

Dear Subscribers,

How exciting to see our first edition of *The Constructivist* in print! It is my hope that you will enjoy reading it as much as Sharon Schattgen and the Project Construct National Center staff, the ACT staff, and I enjoyed putting it together. It took longer than we expected and we apologize for the delay, but we are now "up and running" and should have the second issue ready for publication in the fall.

We will include a "letters-to-the-editors" page and plan to offer a job announcements "bulletin board." If you have any material to send for these sections, please forward them to me at The City College of New York, NAC 3/209a, 138th St. and Convent Ave., New York, New York 10031. We are also soliciting advertisements. Half-page and full-page layouts are being sold. Call Sharon Schattgen at the Project Construct National Center (800-335-PCNC) for further information.

Currently each manuscript is reviewed blind by at least three reviewers before a decision is made to publish it. We hope you will find the quality of manuscripts high and will also consider submitting articles. Articles are sought which address constructivism in a classroom or school-based setting. They should be about ten pages in length and written in a colloquial style. References cited should be listed in APA style. Color photos are encouraged.

Before closing, I want to publicly thank Sharon Schattgen, Theresa Foltz, and Tracy Jensen of the Project Construct staff for all the work they have done regarding this publication. Well over a year ago, ACT considered and deliberated over how to get a magazine off the ground. Sharon suggested that ACT join forces with Project Construct. This collaboration has been fruitful and invigorating. In this interdependent world, such collaboration is necessary and beneficial, and we are eternally grateful for the support provided in this ambitious endeavor.

—Catherine Twomey Fosnot

A Conversation with Rheta DeVries

Catherine Twomey Fosnot

Executive Editor Catherine Twomey Fosnot talks with Rheta DeVries, whose life's work has been about the application of constructivism to education. In this interview, DeVries describes her journey as a constructivist, from graduate student to researcher, writer, and teacher educator.

Let's begin with the beginning. How did you become interested in constructivism?

Well, in 1961, I took a course on child psychology from Helen Koch, who required us to read a book by Piaget. I read *The Construction of Reality in the Child* and was immediately entranced and awestruck by the brilliance of this man and his insights about young children. I later learned that Helen Koch had been introduced to Piaget's work by Larry Kohlberg when he was her student. Larry came from Yale to the University of Chicago the next year, and I then became his student.

So, is that how you got interested in moral development . . . working with Kohlberg?

Well, actually, we didn't work on moral development together. I figured he had already figured that out. I worked with him on cognitive development, and we did factor-analytic research on children's performance on standardized intelligence tests and Piagetian tasks. We modified some Genevan tasks to make sure children were motivated to try to give correct answers. For example, we used candy and bubble gum straws for conservation and class inclusion tasks. My dissertation project was an extension of some of Kohlberg's work and of Piaget's as well.

What was the topic of your dissertation?

It was on children's understanding of the constancy of generic identity. Larry had interviewed young children about whether a cat could become a dog, using pictures. I was skeptical that children believed such a transformation was possible, and I said that to be sure, you would have to interview children using a live cat wearing a mask. Larry said, "OK, why don't you do that?" Then began a search for someone to make masks for a cat! After quite a few people hung up in response to my telephone calls, I finally found an artist willing to undertake the challenge of making realistic dog and rabbit masks. I trained a cat named Maynard to wear the masks and then interviewed children between the ages of 3 and 6 years about whether they believed the animal's identity really changed. I involved them in petting him before and after the transformation and then assessed their emotional reactions, both before the masking and after.

Interesting . . . what did you find?

Well, I found developmental levels. All the 3-year-olds absolutely believed in the transformation in identity. By age 6, only 25% of the children believed in the reality of the transformation. Children who believed in the reality of the transformation and predicted he would bark, chose to feed him dog food when he wore the dog mask. They chose to feed him lettuce when he wore the rabbit mask and predicted he would hop. I had one 3-year-old, for example, who, when I said, "Can he hop?" turned to the cat wearing the rabbit mask and commanded, "Hop, hop, hop for her." When he didn't hop, he turned to me and said, "He don't wants to hop now. He'll hop for you later." So it was that kind of evidence that really convinced me that young children experience the world in qualitatively different ways than older children and adults.

Rheta DeVries and Betty Zan facilitate a workshop for early childhood educators.

And what did you do when you completed your doctoral studies?

I spent a year as a research associate at the University of Chicago, completing a factor-analytic study of Piaget-type tasks and standardized tests of intelligence and achievement with children in three IQ groups. Then in 1969, I went to the University of Illinois at Chicago as an assistant professor. I was there for ten years, two of which I spent in Europe.

What brought you to Europe? Were you in Geneva working with Piaget?

From 1976 to 1978, I had a year of sabbatical from the University of Illinois at Chicago and then a National Institute of Mental Health post doc for a year. I spent these two years in Geneva. The first year I was learning French. It was pretty painful. One of the hardest things that I have ever tried to do in my life is to operate in another language. I sat in on courses even during the first year when I was still studying French. Then the second year I was able to sit in on, not only courses, but the meetings that Piaget conducted in the Center for Genetic Epistemology. Every Monday for two hours there were about twenty people who gathered to discuss theory and presentations of experimental results. It was quite something to watch Piaget doing his research—really a treasured memory.

You worked with Connie Kamii, too, didn't you? When was that?

We started working together around 1971, when I recruited her to the University of Illinois at Chicago. We worked together for about five years before I went to Geneva, and then Connie was in Geneva for part of the time, too. Actually we were writing the books, *Physical Knowledge in Preschool Education* and *Group Games in Early Education*, while I was in Geneva. It was a big distraction from working on French and studying.

And where did you do the work on children's understanding of shadows? Was that in Geneva, too?

No. I did that in Houston, although I started it when I was at the Merrill Palmer Institute. I interviewed children ages 2

through 9 years about their conceptions of shadows. Piaget did that, too, but only with verbal interviews. I developed an active interview where I got kids engaged in talking about shadows of themselves, and shadows of other things, that they could see on the wall and floor.

Rheta DeVries talks with Libby Robinson, a teacher in the Columbia (MO) School District.

What did you find?

Well, I found developmental stages in children's conceptions of shadows. At age 2 years, children believe that the shadow is an object like other objects. That conception even continues with some children as old as 4 or 5 years who try to scrape the shadow off the wall or floor. Young children believe shadows are caused by their own actions, never mind the light! They try to make shadows move from behind to front by leaning in the direction they want to make the shadow! Even at age 9 years, almost all children believe a merged shadow is still there, even though they can't see it.

Really . . . that's fascinating!

Understanding the causality of shadows is a very difficult concept for children to construct because you have to think about the effect of action at a distance, with no direct connection between the object and its shadow. Beliefs about the nature of light are also involved, and it is a great step forward when children begin to conceive of light as active and moving to hit objects.

How did you go from work on physical knowledge, group games, and conceptions of shadows to your more current work on social development?

Well, for twelve years (beginning in 1981), I was director of the Human Development Laboratory School at the University of Houston, working with teachers on developing the entire curriculum. With that responsibility, I had to be concerned about the whole program and not just parts of it. The teacher-child relationship was something that I had thought about for a long time. I had been profoundly influenced by Piaget's book. *The Moral Judgment of the Child,* which I did not read until after I had finished my graduate work. Most people think that my work on sociomoral development stems from work with Kohlberg. Well, it really doesn't. It came after that, as a result of my trying to respond to teachers' concerns about children's competition in group games. I went to that book to find out what Piaget said about competition. I found competition only in about three places. The whole book was actually about cooperation. What I drew from that book that has been very important in my subsequent work is Piaget's discussion of the two kinds of morality and the two kinds of teacher-child relationships that parallel those two kinds of morality.

Would you expand a bit on that . . . perhaps some examples?

Sure. Well, he talked about heteronomous morality in which people follow moral rules because someone else tells them to, perhaps out of fear of punishment. This is in contrast to autonomous morality, where the moral principles are really owned by the person who follows self-constructed principles that guide relationships with other people.

And the teacher-child relationships?

Parallel to the two types of morality are two types of adult-child relations, one being

heteronomous or coercive in which the adult commands and tells children what to do and think and say. In extreme situations, children are so preoccupied with doing what the adult wants that they tend not to reflect, to examine ideas, and to construct them as personally their own. Whereas the second type of teacher-child relationship is a cooperative one in which there is mutual respect, not just unilateral respect. In the heteronomous relationship, the child is expected to respect the adult. In the cooperative relationship, the adult returns the child's respect. In practice, this means giving children choices and encouraging them to regulate their own behavior as much as possible. For me, the first principle of constructivist education is to establish a sociomoral atmosphere in which mutual respect is continually practiced. Betty Zan and I wrote about the practical ways in which teachers can accomplish this in our book, *Moral Classrooms, Moral Children*.

And so a constructivist-based program would be characterized by cooperative relationships. You did a comparison study on this, too, didn't you?

Yes. The study was done in Houston after teachers were implementing a model demonstration program of constructivist education. It then seemed appropriate to go on and ask a comparison question. And I should say that I really did not know the answer, so it felt like a risky undertaking. Actually there were two questions: (1) Would children in a constructivist program progress and develop the way we predicted they would? And, (2) Are children in constructivist programs any different from children in other programs? So, I studied three kindergarten classes, mostly comprised of African-Americans in high poverty areas of Houston. One class had a constructivist program; one was traditional; and one was eclectic with some characteristics of both. What I wanted to look at was the sociomoral atmosphere of the classrooms as well as the sociomoral development of the children. We videotaped the teacher for two entire days and developed a coding system based on Bob Selman's model of developmental levels in interpersonal understanding that were derived from Piaget's theory of perspective taking. Then we were able to assess the degree to which the teachers in those three classrooms were being heteronomous or cooperative with children. We found that the constructivist teacher was much more cooperative and that her interactions with children were characterized by higher levels of interpersonal understanding.

And the results for the children? Where they what you expected?

Yes. We looked at the children in pairs outside of the classroom in a game situation. An experimenter taught them a board game in the first session and then brought them back for a second session and told them that this time they were going to play by themselves. She turned her back and busied herself with papers while they went ahead and played. We did the same kind of coding with the children as with the teachers, looking at their levels of interpersonal understanding. We found that the children from the constructivist classroom manifested significantly higher levels of interpersonal understanding than both of the other two groups.

For example? How was their behavior different?

They were much more cooperative with each other, more respectful. They exhibited more of what we call level two interpersonal understanding, which is taking the perspective of the other person and trying to be persuasive rather than just commanding or using physical force to get what you want. We found much higher levels of the persuasive approach. We also found more shared experience. There are two aspects to Selman's interpersonal understanding conception: one is

negotiation (which I was talking about to begin with), where there is tension in the interpersonal dynamic; and the second is shared experiences, where the interpersonal dynamic is in a kind of equilibrium. It is a friendly or neutral dynamic. There was more of that kind of dynamic in the interactions of the constructivist pairs of children. Moreover, children from the constructivist classroom resolved about twice as many of their conflicts in comparison to the other two groups. So the results were very clear in showing that the answers to those questions were that yes, children in constructivist classrooms are making developmental progress in the direction of reciprocity as we predicted, and they are different from children in classrooms where the sociomoral atmosphere is not as cooperative, but is heteronomous.

And this brings us to your most current work.

I can mention three current projects. One is a study of the effects on young children's moral reasoning in opportunities to discuss social and moral dilemmas from children's story books we published at the Regent's Center for Early Developmental Education. A second is a study with colleagues at the Regents' Center in which we are comparing four instruments that purport to assess developmentally appropriate practice. We are developing our own instrument with a particular constructivist flavor. Third, we are going to write a book on constructivist early primary education with a special focus on academics, based on videotapes we have collected from the best classrooms we know.

We'll look forward to the results. Keep us posted. ❐

Rheta DeVries is Professor of Curriculum and Instruction and Director of the Regents' Center for Early Developmental Education at the University of Northern Iowa. **Catherine Twomey Fosnot** is Executive Editor of *The Constructivist*.

For further reading:

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Rheta DeVries will be a keynote speaker at the 1996 ACT Conference. See page 21 for additional information.

Teaching to Facilitate Progressive Schematization

Maarten Dolk, Willem Uittenbogaard, and Catherine Twomey Fosnot

Constructivism is not a theory of teaching; it is a theory of learning.

Although constructivism has become the newest bandwagon for educational reform, it is not a theory of teaching. Constructivism is a theory of learning. From this perspective, learning is understood as a developmental process of conceptual reorganization resulting from interactions between the learner and the environment and the subsequent generating by learners of reflective abstractions across and beyond these experiences (Piaget, 1977). This conceptual reorganization most often occurs in one of two forms.

The first form requires the coordinating of what at first often seem like discrete, sometimes even contradictory, ideas into a larger encompassing whole structure. For example, when children begin to construct a mathematical understanding of division, problems such as these are often originally seen by the children as very different because their actions in solving the problems are so different. See Figure 1.

1) I have $12; if socks cost $3 a pair, how many pairs can I buy? (repeated subtraction)

2) Socks are on sale at 3 pairs for $12; how much is this per pair? (partitioning or dealing)

Investigating the correspondences and transformations between the groups and the elements in each group, and coordinating these relations (seeing that a round of dealing in the second problem equals a set removed in the first problem), results in the construction of the part/whole relations in division—a larger, more encompassing conceptual understanding. This form of cognitive reorganization requires a reflective abstraction beyond the context and is often characterized by disequilibrium. It has recently been described in the literature as the development of "big ideas" (see Fosnot, 1996; Schifter and Fosnot, 1993).

Rather than a shift in *structure*, a second type of conceptual reorganization involves the refinement of a *scheme*, defined as an organized pattern of behavior (Piaget, 1977). As such, it may not require disequilibrium but may be characterized instead by a search for efficiency. For example, to return once again to division, a context requiring 78 divided by 6 can be solved by repeated subtraction of sixes, or

A constructivist approach to teaching must be based on understanding learning as cognitive reorganization.

Figure 1.
Part/Whole Relations in Division: An Example of a "Big Idea"

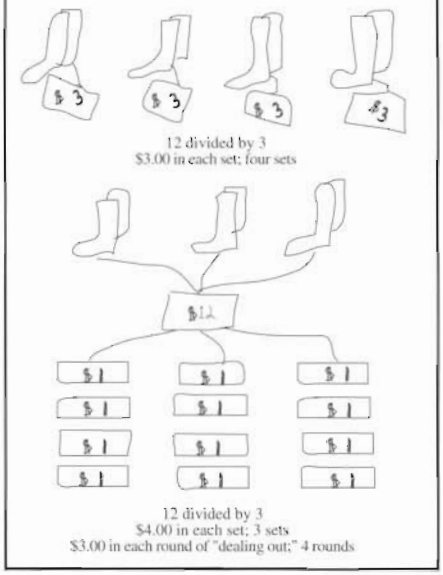
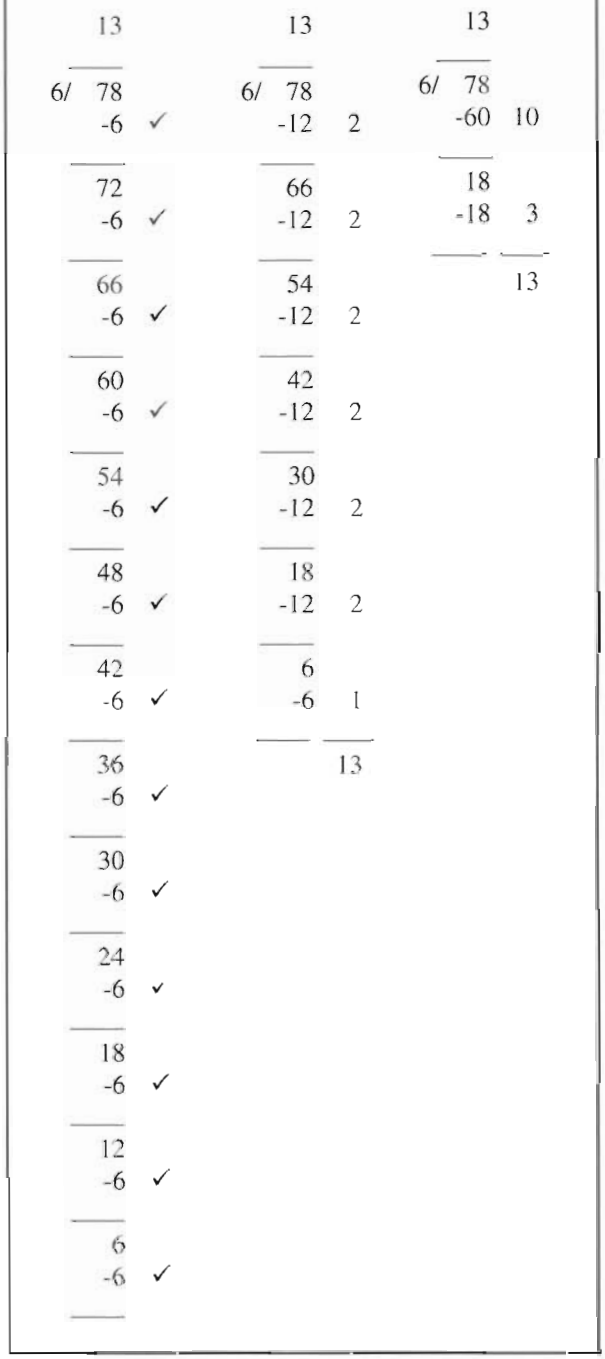


Figure 2.
An Example of Progressive Schematization



subtraction of twelves counted as two groups of 6, or refined by removing 10 groups of sixes at once, and then three. See Figure 2.

This type of cognitive reorganization is termed "progressive schematization" in that the subtraction scheme continues to be employed, but it is progressively refined (Treffers, 1987).

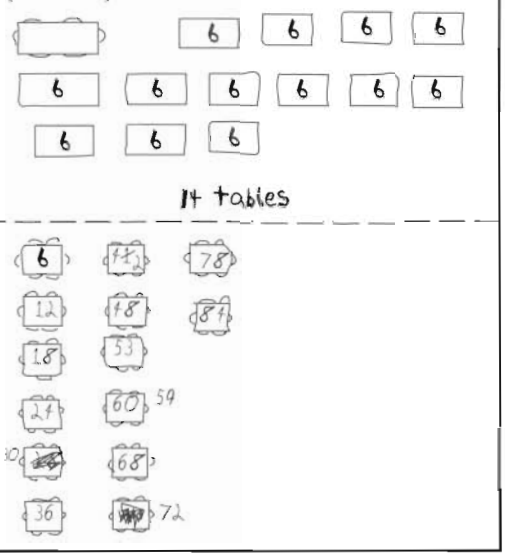
A constructivist approach to teaching must be based on understanding learning as cognitive reorganization. Pedagogical principles that facilitate reordering need to be employed in any approach that is termed "constructivist;" yet, as constructivism becomes the fad of reform, this is often not the case. For example, the use of math manipulatives is often connected to a constructivist approach; learners are often labeled "concrete operational" and required to use base-ten blocks to compute and to demonstrate the trading employed in traditional algorithms. In our minds, such rote use of manipulatives is not constructivist. The pedagogical belief underlying such use is that learning occurs through activity with objects and that this activity in some way structures or transmits information . . . if I *do* it, I *see* it. This belief is based on empiricism, not constructivism.

Kamii's (e.g., 1989, 1993) mental math approach comes closer to facilitating learner-generated ideas. However while the teachers on Kamii's videotapes (e.g., 1990a, 1990b) do bring out children's ideas for discussion, they often do little to facilitate cognitive *re*organization. Most class discussions center on the acceptance or rejection (by group vote) of an individual learner's initial solutions.

Teachers attempting to facilitate progressive schematization, or the development of big ideas, can take a much more proactive role. Investigations should stem from real-life meaningful contexts that elicit learners' schemes. Then contexts should be modified to stretch the initial schemes; models can be provided for consideration, and reflection and discussion on the logic and efficiency of various learner-generated solutions need to be encouraged. Connections across ideas can be explored in "math congresses" (Fosnot, 1989)—whole class meetings where learners present, prove, and defend their thinking to

Investigations should stem from real-life meaningful contexts that elicit learners' schemes.

Figure 3.
Nikola's (top) and Sanjay's (bottom) work



each other. The remainder of this article will describe how one of the authors, Willem Uittenbogaard, attempted to facilitate progressive schematization while working on division with a third-grade class in The Netherlands.

The Lesson

Willem begins with a context meaningful to the children. The class is preparing for an open house at the school. The RSVP slips from the parents are counted, and the class determines that 81 people will be coming. Willem poses the question: "How many tables need to be set up for a school open house if 81 parents are coming and they sit six to a table?" As Willem tells the story, he purposely draws a picture of one table showing each chair and then represents a second table with the numeral 6, instead of drawing each chair. By so doing, he presents a visual image and perhaps some possible strategies, but he does not complete the picture and does not try to lead the children toward the use of one image over the other. He passes out drawing paper and markers, and comments, "You can draw, calculate, whatever you like." He then moves around the classroom, observing and questioning, as the children work, draw, and talk out their solutions with each other.

Nikola draws a table with six chairs first, then proceeds to represent each table symbolically as a rectangle with the numeral 6. While he may have made use of Willem's modeling, he has drawn his tables differently than Willem. As he progresses through the solution, his work shows movement away from the need to count each chair, toward a strategy employing symbolization. See Figure 3.

Sanjay solves the problem by counting on. Like Nikola, he draws each table also, but he marks them 6, 12, 18, etc. Again, see Figure 3. This marking also gives him a way to keep track of the number of people seated as he works.

Noura's solution, on the other hand, is very efficient. She utilizes the distributive property, grouping first 10 x 6, and then 4 x 6. Wendy is developing this strategy as she works through the problem. First, she writes 24 + 6 = 30; then she adds another 6 to get to 36. Next, she apparently changes her mind and writes 10 sixes down; then she crosses them out and writes 60. She doesn't represent the grouping at the end but instead writes all the sixes. See Figure 4. These four solutions are representative of the variety of approaches exhibited in the rest of the children's work.

After giving the children ample time to work on the problem, Willem convenes a "math congress." This is done

Figure 4.
Wendy's (top) and Noura's (bottom) work

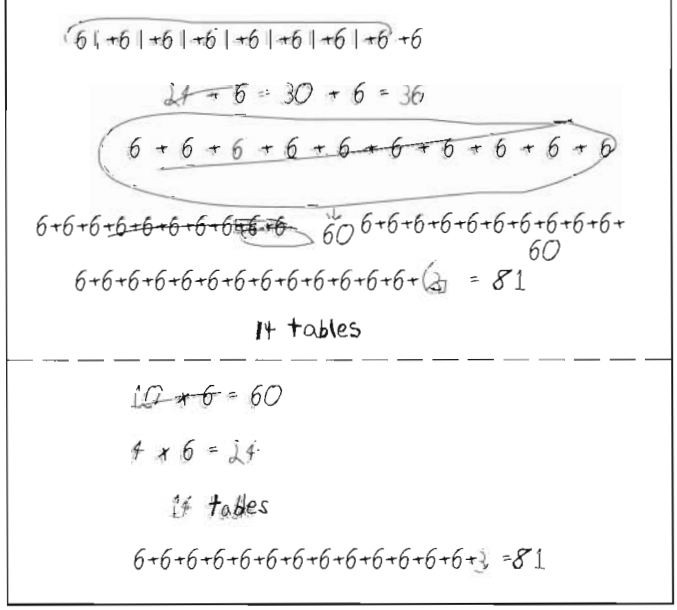


Figure 5.
Valentina's work

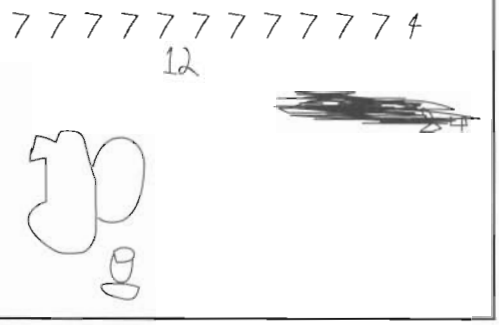
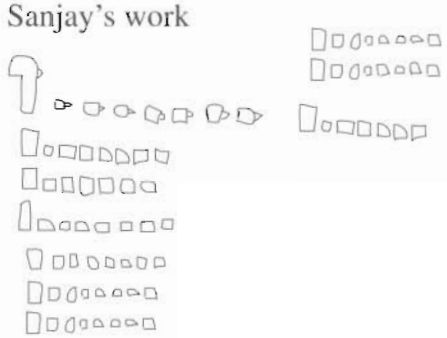


Figure 6.
Sanjay's work



to engage the children in the activity of being mathematicians in a mathematics community; but it is also used by the teacher as a place to scaffold the discussion and to further stretch the children's thinking as they explore connections across solutions. Willem begins with Nikola, whose drawing shows the fourteen required tables. Several children acknowledge that they did it the same way as Nikola. Willem asks Nikola how he knew when to stop. Nikola admits he had to count each table. Willem asks Sanjay to share next. He explains how he counted on as a way to keep track as he went along, and discussion occurs over the numbers he has written on the tables in his drawing, since he miscounted a few times. This strategy of keeping track provides a solution to Nikola's dilemma.

Although Noura had groupings more solidified in her drawing than Wendy, Willem asks Wendy to share in the hopes that the reflection and clarification which will occur as Wendy works to explain her thinking to the others will help her become clearer herself. This seems to work, since her verbal explanation is that she took ten groups of sixes out at once, even though her drawing shows that she worked up to this process. The children comment on Wendy's shortcut and, in the ensuing discussion, Willem asks the children to consider the efficiency in Wendy's solution and suggests (only as a possibility) that they might want to consider using her strategy in similar problems.

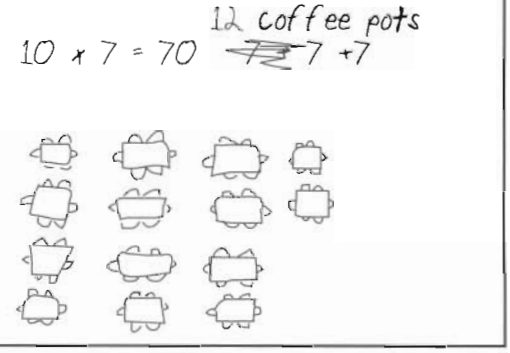
For a subsequent problem, Willem chooses a context and model that do not lend themselves well to counting in the hopes of moving children like Nikola and Sanjay away from counting one at a time. He asks them to investigate how many pots of coffee need to be made for the parents, if each person has one cup and each pot makes seven cups. As he tells the problem, he draws a coffee pot as a model (which is not so easy to draw or to demarcate each cup) in the hopes that the context might facilitate the use of symbolization, and/or grouping.

Valentina begins by drawing the pot, but she quickly gives up and uses symbols. With the earlier problem she had drawn every table. See Figure 5.

On the other hand, Sanjay still draws all the cups. Some children like to draw, and he may prefer this strategy for that reason. As far as we can see, though, the context does not seem to affect his strategy, although the handle does disappear and the picture becomes more symbolic. Twice he even counts the coffee pot as a cup and only makes six other cups. He does not finish the problem, however, because of all the time he takes for the drawing. See Figure 6.

Anita really changes her strategy. She moves from drawing every table to an efficient grouping of 10 x 7. See Figure 7.

Figure 7.
Anita's work
Coffee pot problem and table problem



Wendy continues to group the sevens by ten, although she still represents each seven. Noura further refines her strategy. Now it is nearly mental. She writes 10 x 7 = 70, then 11 x 7 = 77. She does the rest in her head and simply writes 12 pots. See Figure 8.

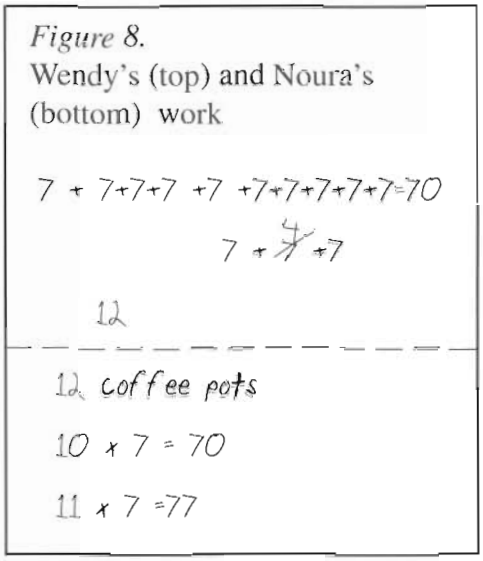
Conclusion

Although Willem's facilitation and context choice did not cause every child to restructure his or her thinking, the children's work shows that the teacher can play an active role in facilitating cognitive reordering. The design of the context and the structuring of the whole-group discussion are critical in developing progressive schematization.

As constructivism has begun to inform pedagogy, often only surface pedagogical principles have been employed, such as collaborative learning, the use of manipulatives, real world contexts, or questioning rather than lecture. The application of these strategies by themselves, without an in-depth understanding of learning, has often resulted in little content being learned. Our present reform initiatives will be critiqued justifiably and will once again fail, if we interpret constructivist teaching simply as pedagogical strategies and do not take seriously constructivism as a cognitive learning theory. ❐

Our present reform initiatives will fail if we interpret constructivist teaching simply as pedagogical strategies and do not regard constructivism as a cognitive learning theory.

Figure 8.
Wendy's (top) and Noura's (bottom) work



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The Learning Laboratory: An Ongoing Conversation

Kathleen Martin and Sherrie Reynolds

Our partnership's primary purpose is to understand the conditions that promote and support children's learning.

Educators from a number of institutions have recently formed a partnership of persons who want to share ideas between institutions. Our partnership began with the Texas Christian University School of Education and the Fort Worth Museum of Science and History and has extended to schools and corporations in the Dallas/Fort Worth Metroplex. Our primary purpose has been to create a dynamic educational community that is seriously engaged in understanding the conditions that promote and support children's learning. Through extended conversations, we have come to see the constraints of institutional isolation and the possibilities that come with institutional cooperation. In discovering our common educational interests, we have sought to optimize the expertise and appropriate contributions of each participant while simultaneously advancing our communal insight. Our conversations were an initial condition for our own learning. This initial condition has generated actions among us which, when reflected upon and discussed, have made other conditions for learning more visible to us. Awareness of these conditions has resulted in the emergence of a new learning environment called *Hands On Science.*

A Learning Laboratory

Hands On Science is a 2,200 square foot learning laboratory located in the Fort Worth Museum of Science and History. The sponsorship of Lockheed Martin made the renovation of the space possible and helps support its operation. Funding from the National Science Foundation and the Exxon Education Foundation have supported the teacher preparation and teacher enhancement efforts and the research conducted within the lab. The expertise of staff from The Container Store has helped us see new opportunities within the space and maximize its use. This space constitutes a neutral zone of sorts that seeks to guarantee and further extend conversations between the institutions out of which it originated.

Teachers bring their students to the learning lab where they can encounter and learn about science and mathematics in a wide variety of captivating contexts. The atmosphere of the lab is permeated by a deep sense of learning as a self-organizing organic process that can be cultivated but not controlled. Within the lab, we encourage a view of learning consistent with Piaget's description of knowledge as a series of

The research reported in this paper was supported by the National Science Foundation and the Exxon Education Foundation. The opinions expressed herein do not necessarily reflect the position, policy, or endorsement of the foundations.

We encourage a view of learning consistent with Piaget's description of knowledge as a series of useful constructions that are invented by individuals through interactions with objects, operations, and ideas.

useful constructions that are invented by individuals through their interactions with objects, operations, and ideas. We also espouse Dewey's notion that psychological constructs like attention, interest, motivation, and effort do not reside "in" children's heads but rather are present in the relationships "between" children and the environments that engage them. Consequently, the lab offers learning environments that invite children to attend and that stir their thought. Children become interested, and that interest motivates them to greater effort; this effort results in increased depth and scope of thinking.

The [illegible]g environments in the lab [illegible]ge children to act; they observe, try things out, solve problems, predict, test, adjust, and retest. The environments also encourage social processes—watching someone else, looking at models, asking questions, sharing what they find out, working with others. The conditions for acting and interacting are permitted and possible in the lab, but they are not controlled and planned. As children experience the needs of their own growth processes, they are allowed to seek out the conditions that seem to work best for them at the time.

While an environment of enough depth and complexity to offer interesting and engaging possibilities is a necessary condition for learning, it is not sufficient. The lab provides children with things to think with and about; this environment thus creates conditions for learning and teaching. The task of the teacher in the lab is to observe the children's thought carefully in order to make judgments about appropriate responses. Teachers need to have sufficient sensitivity, interest, and belief in the vital organic processes involved in the growth of children's intellectual lives to allow children to learn. Fascination with the development of children's thought and respect for its continued unfolding are essential conditions for teaching in the lab.

The task of the teacher is to observe the children's thought carefully in order to make judgments about appropriate responses.

Dewey (1929) describes *care* as "cherishing attention to that in whose potentialities we are interested" (p. 225). This is the kind of caring that we ask of teachers in the learning lab. Out of this caring relationship teachers can see moments when a child is caught by something and needs to pursue it, or determine when it is time to move on, or ascertain when to give information or provide sources of information. There are no rules, no methods, no prescriptions. Just as learning is seen as an organic process that can be cultivated but not controlled, so is teaching viewed this way in the lab.

Our work in the learning lab has made it evident that such spaces can only operate as self-organizing environments that are pedagogically appropriate if they are centered around a responsible, mature care for children. Such care is the initial condition for learning. Once that initial condition exists, then

The focus is not so much on outcomes, but on the feedback process, which allows children and teachers to adjust and readjust their expectations through ongoing questioning and reorganization of experiences.

Photos courtesy of Kathleen Martin and Sherrie Reynolds

Photos 1 and 2.
Children investigate the fossils found on their hunt. A "dino detective" takes a close look at a Museum dinosaur bone.

other conditions emerge that sustain the learning. These sustaining conditions rely heavily on feedback for ongoing self-correction. This self-correcting process allows the child to continually reconstruct concepts. The focus in the lab is not so much on where things are going—outcomes—but on the feedback process, which allows children and teachers to adjust and readjust their expectations through ongoing questioning and reorganization of their experiences (Dewey, 1963; Piaget, 1973). Where adaptability is evident, we know that conditions in the lab are working to sustain learning.

The learning lab is a place where teachers can re-envision traditional notions of teaching and learning. Teachers who are able to "see children" and care for them in the way described by Dewey begin to imagine different conditions for learning and new possibilities for building those conditions in their schools. The opening of these possibilities engenders hope and determination which lead to action.

Charla's Learning Lab

Charla is a second-grade teacher who has begun to rethink the conditions for learning within her school. Her students and those from a neighboring kindergarten class spent a week together in the lab investigating fossils and dinosaurs. See Photos 1 and 2.

While watching the children work on projects together, Charla became particularly sensitive to the ways in which the children shared their experiences and talents. She described the partnership between second-grader Billy and kindergartner Joshua (see Photo 3):

Billy started immediately writing ideas on notebook paper, but stopped to watch the detailed drawings of Joshua. Billy thought they were "awesome" and made a deal with Joshua. Billy agreed to write Joshua's sentences for him if he would draw pictures for Billy, or at least help him draw.

A veteran teacher and practiced "kid-watcher," Charla carefully recorded and then thoughtfully discussed with the university staff the transformations that she noted in the

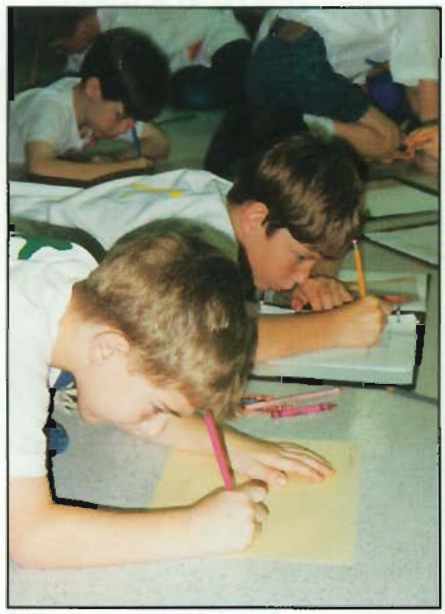
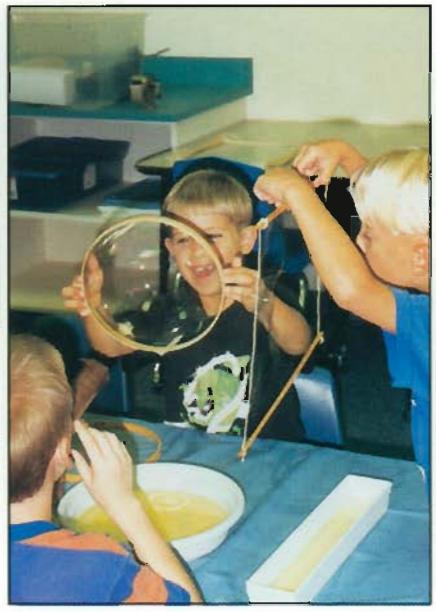


Photo 3.
Billy and Joshua work together on their journal.

children. She observed the second graders shift from being caretakers to teachers and then to learning partners. She also observed the growth in confidence of the kindergartners as they increasingly shared and even began to initiate experiences. By the end of their week together, Charla felt that the students and teachers and museum and university educators had become like a large family. Sharing and learning were evident everywhere—between children and children, between children and grown-ups, and between grown-ups and grown-ups. She began to see the multi-age grouping of children and the collegiality among educators as important conditions for the growth of her students and for her own professional development.



Photos 4 and 5.
Charla illustrates some possibilities with soap bubbles, and the children follow her lead.

In her determination to recreate in her own school the learning conditions that she had encountered in the lab, Charla persuaded her principal and other school officials to designate a room in her school as a learning lab. She then sought and received a small teacher-initiated reform grant to buy materials for the lab. Other teachers in the school have joined with Charla and their shared enthusiasm, combined with the support and encouragement of the principal, is leading them to reconsider traditional grade-level groupings. The resulting ideas are allowing children of various ages and their teachers to flow together in the lab, thereby creating new conditions for learning.

Charla has borrowed many "kid-watching kits" from the Museum and has used these mini-labs as prototypes for some of the environments that she has developed in her school's learning lab. These include numerous construction kits such as Kaplas and Legos, as well as tried-and-true traditional environments such as magnetism and soap bubbles. See Photos 4 and 5.

Charla has found a new enthusiasm for teaching through the side-by-side learning she now engages in with her students.

These learning environments have been as enticing to Charla as they have been to her children. A veteran teacher of many years, Charla has found a new enthusiasm for teaching through the side-by-side learning she now engages in with her students. She has come to realize that she models more than concepts when she teaches; she models the process of learning. She thereby makes visible to the children the value she accords learning in her own life.

Melissa's Dinosaur Exhibit

Melissa is a third-grade bilingual teacher whose efforts brought the Museum and Hubbard Heights Elementary together in a unique project. Her students came to the lab for two weeks to learn about dinosaurs and the work of paleontologists. They dug up bones, laid out grids to mark their location, and

Photos 6 and 7.
Susan digs a dinosaur bone out of its encasement. Melissa and Yajaziel examine a dinosaur model.

extracted the bones from their encasements. See Photos 6 and 7.

After simulating the activities of paleontologists, they listened to the stories of real dinosaur diggers and asked questions about the ancient creatures and their contemporary progeny. The children were also led by Karen Carr, the artist who created the drawings for the Lone Star Dinosaur Exhibit, to make clay renditions of nodosaurus and tenontosaurus while learning fascinating facts about dinosaur anatomy and physiology. See Photo 8.

During the course of their two weeks at the Museum, the third graders encountered over a dozen adults who were deeply excited about and committed to the work they were doing. Dewey (1913) has said that things are of interest to children "only when they are encompassed with the interests they see exemplified in persons" (p. 86). This social referencing helps children find meaning and worth in objects. Melissa recognized and reflected upon this tendency in children. She overheard Saul remark on his delight in discovering that he could actually make a career out of pursuing his interest in dinosaurs. And she noted Erica's concentration in shaping her clay dinosaur and fashioning it with the same motions as demonstrated by the artist.

Melissa had already been questioning traditional modes of assessment and their worth for her students. The intense involvement evident in the faces of the children and their enthusiasm for participating in the learning of the grown-ups around them confirmed for Melissa the significance of her questions and the artificiality of so much of the assessment conducted in school. She realized that she could convey to her students a true sense of the value of their activities only if she first possessed that sense of value through her own engagement.

Consequently, Melissa has worked with her third graders to design a dinosaur exhibit based on what they learned during their time at the Museum. See Photo 9.

This exhibit opened in concert with The Lone Star

Photos 8 and 9.
Karen gives Erica a hint about how to fashion the clay for her dinosaur. Robert, Roberto, and Gerardo look over the dinosaur artifacts for their museum exhibit.

Dinosaur Exhibit designed by the Museum. When the Museum ships its exhibit to another museum site, the children will ship their exhibit to another school which is partnered with a museum. The exhibiting of their work and the sharing of that exhibit has allowed the children to identify and commit to the value of their work. Because their exhibit is done in concert with professionals, the children have been provided opportunities for critique which have deepened the evaluation process.

While Museum educators shared their expertise on dinosaurs and paleontology with Melissa, she shared her expertise in bilingual education and the needs of the bilingual community with them. Consequently, the Museum educators have become more sensitive to cultural diversity and to the values within those cultures. Many of the families of Melissa's children came to the Museum for the first time in conjunction with the two-week visit of the children. Both Melissa and the Museum educators are committed to extending that interaction. As they continue to develop their dinosaur exhibits, they will no doubt open more opportunities to guarantee the ongoing exchange of ideas and persons.

The intense involvement evident in the faces of the children and their enthusiasm for participating in the learning of the grown-ups around them confirmed the significance of questions about the value of traditional modes of assessment and the artificiality of much of the assessment conducted in school.

Continuing the Conversation

Through our work together as educators, we have begun to understand that we suffer constraints in our thinking as much as within our institutional structures. We have learned that ongoing and thoughtful conversation is a necessary and sustaining condition for loosening up our thinking so it can intermingle with the thinking of others. The actions that we have taken to build a learning laboratory and the subsequent actions taken by teachers who have participated in the events of the lab have emerged as mutual opportunities that have benefited all the participants in our educational community. These actions were not planned prior to our conversations and interactions with one another. Rather, they came about through thoughtful and persistent dialogue. Thus, we have come to realize that our actions are conditions for our thinking together just as the thinking together is a condition for our actions. ❐

We learned that ongoing and thoughtful conversation is a necessary and sustaining condition for loosening up our thinking.

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They wish to thank Charla Smith, second-grade teacher at Grace-Hardeman Elementary in Birdville ISD, and Melissa Manzano, third-grade teacher at Hubbard Heights Elementary in Fort Worth ISD, for their enthusiasm and professional insights.

ACT Annual Conference

November 7–9, 1996
St. Louis Frontenac Hilton
St. Louis, Missouri

The 1996 ACT Conference Program will be included in the fall issue of *The Constructivist*. For a registration form and lodging information, contact Maurita McCarthy at the Project Construct National Center at (800) 335-PCNC or visit ACT's World Wide Web site at http://www.columbia.edu/~vdn1/ACT.html.

Check the following World Wide Web sites for on-line information about the city of St. Louis: http://www.st-louis.mo.us/touring/ "Touring St. Louis;" or http://aix.cait.wust/.edu/ "Meet Me in St. Louis." Go to http://www.hilton.com/hotels/STLFHHF/index.htm/ for additional information on the St. Louis Frontenac Hilton.

Keynote Speakers:

Lucy Calkins
Columbia University Teachers College

Rheta DeVries
University of Northern Iowa
(co-sponsored by the Jean Piaget Society)

James Wertsch
Washington University

Co-sponsored by

Project Construct National Center

Webster University

Missouri Department of Elementary and Secondary Education

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Letter to the Editors

Dear Editors:

In the summer of 1990, I was selected to become a Fellow in the California Science Project (CSP) in Sacramento, California. I came to CSP as a preschool- and elementary-level teacher with twenty years of teaching experience. Until this experience, I had always felt my area of strength was in teaching reading and language arts. CSP transformed my views of teaching and learning. My group had the good fortune to be the first year of a project at University of California—Davis whose focus was a constructivist teaching/learning approach. Rather than "filling us" with science content, our project taught us through a constructivist approach. We were given the experiences that we did not receive in our own schooling. The common ground for those of us selected was experience in working with second-language learners. As we came to understand the implications of constructivism for the classroom, we began to appreciate how perfect the approach is for teaching second-language learners.

Since making the paradigm shift, I am unable to conceive of teaching practices without a constructivist approach. In 1991, I was able to join ACT and to attend the conference at University of California—Berkeley and meet Vivian Paley and Catherine Fosnot, whose writings I had discovered during the Project. My search for more readings on constructivism has been frustrating until very recently. I appreciate that ACT continues to provide a link for classroom teachers and leadership in constructivist research. I applaud your intention to expand into a magazine format and look forward to reading my first issue.

Sincerely,

Julie Hisaka
1050 Clarane Avenue
Stockton, CA 95207
E-mail: jhisaka@sjcoe.k12.ca.us

ACT is the. . .



ASSOCIATION for CONSTRUCTIVIST TEACHING

Constructivist teaching provides a rich, problem-solving arena that encourages the learner's investigation, invention, and inference. The constructivist teacher values learner reflection, cognitive conflict, and peer interaction. ACT is a professional educational organization dedicated to fostering teacher development based on these principles.

Our Mission . . .

Is to enhance the growth of all educators and students through identification and dissemination of effective constructivist practices in both the professional cultures of teachers and the learning environments of children.

Membership . . .

Is open to anyone interested in the field of education including classroom teachers, administrators, supervisors, consultants, college and university personnel, students, and retired educators.

ACT Goals

1. To provide increased and varied resources to an expanding membership.
2. To increase attendance at and participation in ACT's annual conference.
3. To publish effective and practical strategies for applying constructivism in the classroom through ACT's scholarly magazine, *The Constructivist*.
4. To provide a network through which teachers, researchers, speakers, and other professionals can support and extend each other's efforts to integrate Piaget's theory of learning into their classroom and within the context of federal, state, or local mandates.
5. To encourage members to contribute actively to the association's development and engage others in expanding the network of those who are willing to support each other's growth as constructivists.

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