THE CONSTRUCTIVIST

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ASSOCIATION for CONSTRUCTIVIST TEACHING

Annual Conference

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ASSOCIATION for CONSTRUCTIVIST TEACHING

Contents

1 **A Letter from the Executive Editor of *The Constructivist***
Catherine Twomey Fosnot

2 **A Letter from the President of the Association for Constructivist Teaching**
Paul Ammon

4 **A Conversation with James V. Wertsch: Part II**
Brenda Fyfe

9 **Teaching to Facilitate "Progressive Schematization" or Reflective Abstraction?**
Constance Kamii, Faye B. Clark, and Ann Dominick

14 **Letters to the Editors/Classified Ads**

15 **The Role of Context in Mathematics Learning: Reply to Kamii, Clark, and Dominick**
Catherine Twomey Fosnot and Maarten Dolk

21 **Preliminary Program of the Annual ACT Conference**

24 **Registration Form for the Annual ACT Conference**

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A Letter from the Executive Editor of *The Constructivist*

Dear Readers,

In this issue of *The Constructivist*, we bring you the kind of debate and dialogue that we hope will come to characterize the magazine. Constance Kamii and her colleagues, Faye Clark and Ann Dominick, provide a provocative response to an article that appeared in *The Constructivist*, Volume 11, No. 1, Summer 1996, which I co-authored with Maarten Dolk and Willem Uittenbogaard. And, in the spirit of constructive conversation, Maarten and I offer a reply to Kamii et al.'s comments.

This issue also includes the second part of Brenda Fyfe's comprehensive interview with Vygotskian scholar James V. Wertsch. Their rich discussion is helping us all to develop deeper understandings of how Vygotsky's theory relates to other theories of learning and how it informs educational practice.

In this issue, you will also find the preliminary program and registration form for the upcoming ACT conference, which is scheduled for November 14–15 at The City College of New York. The meeting includes a full complement of interesting keynote addresses by such acclaimed speakers as Frank Smith and Alfie Kohn and great workshops that promise to be stimulating as well as enjoyable. I hope that you will take advantage of this opportunity to further your own professional growth as well as to enjoy the sights and sounds of New York City.

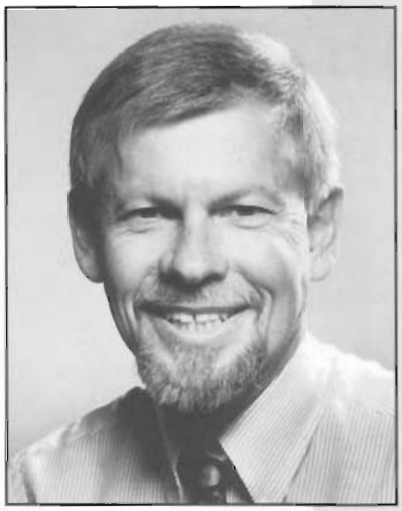
A letter from me would not be complete without a plea for manuscripts! If *The Constructivist* is to reach its true potential as a reform tool, we need many good articles from professionals who are engaged in the difficult work of translating theory to practice. Articles should be approximately ten pages in length and written in a colloquial style, with references cited according to APA guidelines. We especially seek articles that speak to practice, and we encourage you to submit illustrative photos (with appropriate written permissions from subjects) along with your text. Upcoming issues will focus on the role of affect and developing a classroom community; teacher education; and on the perspectives from the disciplines (e.g., mathematics, literacy, science). Submit manuscripts to: Catherine Twomey Fosnot, The City College of New York, NAC 3/209a, 138th Street and Convent Avenue, New York, New York 10031.

Finally, don't forget to pay your ACT membership dues, so you will continue to receive *The Constructivist*. If you did not receive a dues statement recently, just complete the membership form on the inside of the back cover and return it with your check.

I hope to see you in New York in November!

—Catherine Twomey Fosnot

A Letter from the President of the Association for



With my term as ACT's president coming to a close, this is my last president's letter, and I want to focus it on two opportunities that are coming up in the near future. The first is the opportunity all of us will have to attend ACT's Annual Conference in New York on November 14 and 15, 1997. (See pages 21–24 for the preliminary program and registration form.) Last year's conference in St. Louis will be a hard ACT to follow (pun obviously intended!), but Cathy Fosnot has done her best to organize another excellent meeting, and anyone who knows Cathy knows that she will succeed. I have no doubt that those of us who attend will regard the ambiance of City College and Manhattan as a wonderful frosting on an even more wonderful ACT cake.

A second opportunity I'm looking forward to is the one that I will have when I guest edit a future issue of *The Constructivist* devoted to articles on teacher education and teacher development (thanks, again, to Cathy Fosnot). This will create an opportunity for some of you to report on your work in educating other teachers, or in pursuing your own professional development.

Having worked for several years at preservice teacher preparation (in the Developmental Teacher Education Program at Berkeley), I have come to appreciate how much dedication and hard work it takes—on the part of student teachers, cooperating teachers, supervisors, and course instructors—for new teachers to get off to a good start in becoming constructivist teachers. At the same time, I must admit that I have considered myself lucky to be working at the preservice level, because the challenges of inservice teacher education seem even more daunting (and probably are). Recently, however, I have seen firsthand how much can be accomplished at the inservice level as well.

For the past two years, I have been privileged to work with Mike Schooley and Sharon Schattgen in the New Schools Pilot Project at Derby Ridge Elementary School in Columbia, Missouri—a project that aims to transform an entire school into a thoroughly constructivist learning environment, which is well on the way to succeeding. In my role as "internal evaluator," I have watched highly talented consultants in mathematics and writing instruction work with the teachers at Derby Ridge in a staff development effort that is both intensive and extended over time. I have also seen evidence of remarkable development on the part of the teachers and their

students in response to this effort. The teachers are now approaching their work in ways that seem increasingly consistent with constructivist views of learning, and the children are showing just how far they can go when they are taught that way.

As inspiring as the results at Derby Ridge are, they are not unprecedented. Constructivist teacher education programs in other places have also enjoyed some real success—for example, Project Construct in Missouri, the math programs based at the University of Alabama and at Mount Holyoke College, or Writing Projects in a number of places. Thus, there are many stories to be told, in both inservice and preservice teacher education, about successful efforts to promote the development of constructivist teachers. These stories need to be shared, so we can learn from each other in order to extend and adapt our work to a wider variety of settings, to make constructivist teaching less and less an exception and more and more the norm.

—Paul Ammon

A Conversation with James V. Wertsch:

Brenda Fyfe

ACT Board Member Brenda Fyfe continues her conversation with James V. Wertsch, a Vygotskian scholar and one of the keynote speakers at the Association's 1996 conference. In this part of their dialogue, Wertsch addresses the implications of Vygotsky's theory for education.

One Vygotskian concept that seems to be very useful to educators is the zone of proximal development. Would you briefly define this concept and explain the significance you think it has for educational practice?

Actually, I think that to some degree the zone of proximal development has been overemphasized in Vygotsky's heritage. First of all, I think the zone of proximal development is just one illustration or example of what he called the "General Genetic Law of Cultural Development." This law states that higher human mental functions appear on two planes, first on the social or intermental plane, then on the individual, or intramental plane. The zone of proximal development is just one version of this more general kind of claim that Vygotsky wanted to make. Specifically, the zone of proximal development is the distance between what a child can do independently and what a child can do with more expert help. It's something that has received a lot of attention, because Vygotsky pointed out that it's a way to think about instruction. Mainly we should be instructing not at the lower level of actual development, which is determined by what the child can do independently, but at the level of potential development, which is what the child does with the more expert teacher or tutor.

Vygotsky also mentioned that the zone of proximal development has implications for mental testing. Most mental testing as he saw it (and I think this is just as accurate today) was geared toward where we've already been. The idea is to devise mental tests that look at the level of potential as well as the level of actual development.

One of the reasons the zone of proximal development has received so much attention is because it rings true with a lot of people. It has a lot of appeal for those who are interested in diagnostic teaching, for example. One of the big problems, however, is how to measure these two levels. Intermental functioning on the social plane is negotiable. It's not something that is set once and for all. A good teacher could take this further than a poor teacher. So, in a sense the level of potential development is not solely a property of the individual. It is a measure related to the social dynamic

Part II

and competence of the tester and the individual being tested. This makes us uncomfortable because what we usually talk about is the testing of individuals. We don't even understand what testing means for the most part if we don't make this assumption. In addition, there is no way to come up with ironclad, mechanistic tests that would determine everyone's level of potential development.

From a Vygotskian perspective, terms such as thinking or mental achievement are terms that apply to social as well as individual processes. Some people have been looking into this. Barbara Rogoff, for example, is looking at the notion in education of developing a community of learners. She is saying that it is important to not only look at how individuals develop by virtue of participating in communities of learners, but to also consider how the whole community of learners develops. In this way, development is a term that applies to the social processes as well as to the individual. Some groups are more highly developed in that they solve problems more successfully than other groups. Here again, is where Vygotsky's concepts can be productive. He challenges us to think about applying terms like development, thinking, reasoning, problem solving, and development to groups as well as individuals.

It seems to me that so much of our approach is rooted in the value we place on rugged individualism versus the good of the social collective and the development of the community.

That's actually a very important point. I think what happens is that any time a theoretical perspective travels from one society or one culture to another, it gets assimilated; I guess in Piagetian terms, it is assimilated into a new perspective. When an individualistic society, like ours, takes over ideas that have been developed in a society that is much more focused on the collective and social unit, we have to watch ourselves. It is easy for us to inadvertently translate Vygotsky's ideas with more emphasis on the individual than he ever intended. The kind of thing you're talking about, individualism, is not such an obvious and comfortable concept in Russian culture as it is in American culture.

The terms "scaffolding" and "mediators" are frequently associated with social constructivism. In the first part of our conversation you spoke of mediational tools. Would you share your views on these tactics for supporting learning?

Well, first of all, Vygotsky never used the term scaffolding, and that's actually a case in point of what I was talking about earlier regarding the American frame of reference being imposed on his ideas. Scaffolding is a metaphor that has problematic implications for social constructivism. A scaffold is something you build up. You build a structure beside it, then build up the scaffolding some more, and the structure gets built up more. Eventually you take the scaffolding away. The problem is that this metaphor fails to account for qualitative transformation. If we apply the building analogy to the concept of qualitative transformation, we might say it's like you have built a partial structure. Then you say, "That really works well for this stage of development, but now we're going to have to tear the whole thing down and switch from building in wood to building

in brick." We don't do that with scaffolding. Scaffolding has this kind of incremental quantitative development notion built into it. Vygotsky often talked about the differences between revolutionary and evolutionary changes, or qualitative and quantitative changes. During qualitative change, you have major upheaval, regressions. Things like that are not uncommon. That's why I resist substituting scaffolding for the terms mediation or zone of proximal development.

The notion of mediation is central to Vygotsky's understanding of human action, including speaking and thinking. Perhaps the major contribution he could make to discussions of constructivism would be in this connection. Specifically, Vygotsky argued that we never speak, think, or otherwise act without using cultural tools or mediational means. In the cases of speaking and thinking, he focused particularly on language as a cultural tool. On the one hand, this cultural tool does not mechanistically determine what we do. Individual acts of speaking are always unique and involve an element of novelty, if not creativity. On the other hand, however, we do not act in a sociocultural vacuum. Specifically, we do not act without using cultural tools such as language, computers, calculators, or other mediational means.

Where would you suggest our readers look for examples of educational practices that have been influenced by the study of Vygotsky? You already mentioned the work of Barbara Rogoff.

Certainly I would recommend a lot of Barbara Rogoff's work. Perhaps her best-known publication in this regard is her 1990 volume, *Apprenticeship in Thinking* (Oxford University Press). No matter how long a list I give you, I'm going to leave out several important contributors, but here are a few. Michael Cole has been a major contributor in terms of bringing Vygotskian ideas to educational settings. His recent book, *Cultural Psychology* (Harvard University Press, 1996), is just the latest installment in his long list of contributions. He and his wife, Sheila Cole, have written an extremely interesting textbook titled *The Development of Children* (Freeman, 1996) that is grounded in many respects in Vygotskian ideas. Of course, Jerome Bruner has been a major figure in discussions of educational practice in the United States, and he traces his influence from Luria and Vygotsky back several decades. His most recent book, *The Culture of Education* (Harvard University Press, 1996), is just the latest of several major works in this area.

Would you share with us some of your current work and interests?

Well, I'm very interested in how learning or discourse occurs in museums today. I'm also thinking about the use of narratives as cultural tools, and especially about narratives as ways of representing history. I'm looking at the roles of narratives in identity formation, either group identity, like national identity, or individual identity. This is an area Vygotsky never talked about, so I can't claim it as Vygotskian. But for me it was certainly inspired to a degree by his thinking.

We have a collaborative study going now with colleagues in Russia, Ukraine, Estonia, and here in which we are looking at "man on the street" ideas about the history of World War II. This history is generated when people use the existing narratives given to them through media, textbooks, family stories, and other sources. We see examples of the kind of irreducible tension that I mentioned earlier in regard to the world and the human mind and in regard to the fact that you can never have assimilation without accommodation. Human action always involves irreducible tension between human action on the one hand and the cultural tool on the other. In this case, the cultural

tools are those stories or narratives provided to us. We don't create them ourselves; we don't do original historical research for the most part. They kind of evolve from what the moral philosopher, Alastair MacIntyre, calls the stock of stories that are out there. We employ this stock of stories in order to think and speak about things like World War II and to understand our connection to that story. In our current research, we are interested not only in what people can memorize and internalize cognitively, but in how they relate to these cultural tools in an affective sense, with a kind of commitment to them.

And so you are connecting this process with ways in which museums are taking an active role in helping visitors relate to cultural tools?

Yes, I'm particularly interested now in how museums, particularly history museums, not only try to teach us facts about the past, but are intended to shape our identity. They don't want us to just learn about things in the past, but rather to make these things a part of ourselves as citizens of the state.

Ten years ago I went to a museum in Israel, the Museum of the Diaspora, which is designed to get people not only to understand facts, like how many synagogues were in Hungary, Czechoslovakia, or Russia, but to think through the process of understanding themselves as part of a history and a humanity, Jewish humanity in this case. The museum is organized in such a way that the visitor looks at the various Diaspora exhibits from bottom to top. When you arrive at the top, you come into a big card catalog area (I'm sure it's computerized by now). Helpers are there to answer any questions about names of anyone you happen to know who disappeared in the Holocaust. It's a very powerful example of getting people not just to understand or know stories, but to really believe and be committed to a story that can become a part of them. The Holocaust Museum in Washington, DC, does similar kinds of things. The Meet Me in St. Louis Exhibit is another example. It is not just an attempt to get people to know more information, but to think of themselves as St. Louisans—to relate to the 1904 World's Fair story in a way that makes it part of their own story and makes their story a part of that story. From this perspective, the job of the history museum curators is to give us the set of narratives that they think are useful in creating our own identity. It is an example of using narratives as cultural tools that help frame the notion of identity.

Fascinating! I have colleagues at Webster University whose work would closely relate to these ideas. They are experimenting with ways to help students make personal connections with global issues and events.

I take my Vygotsky heritage very seriously wherever I go. In the fall of 1997, we will offer a course here for freshmen called "Global Processes and Local Identities." We are trying to deal with some of the same issues in this course. People think that nation-states have been too good at getting us to buy into their stories of where our identity starts and stops. We have to think about a different kind of unit rather than nation-state as the source of some of the stories with which we want to identify today.

Have you written anything recently on this subject?

Yes, I have collaborated with some colleagues in Estonia and in Russia to look at, for example, the situation in Estonia. While under Soviet rule, the Estonians had to study an official stock of stories about their history that were given to them by the Soviets. Students had to know these in order to get through school, like we have to know American history in order to graduate from school. On the other hand, ethnic Estonians

never believed those stories the Soviets handed down, so there was a sort of dual curriculum—the official history they had to learn in school, and the unofficial history that every Estonian knew from home, parents, and friends. We studied how people related to the official history. The counterpart in the United States is with minorities. A lot of people have pointed out that you can get people to memorize enough to get out of the high school history class, but some people are going to believe it more than others, and some people just don't believe it at all.

Where would we find these writings?

I have integrated a number of these studies and included them in a new book, *Mind as Mediated Action*, to be published by Oxford Press in 1997. In 1994, a special issue of the *Journal of Narrative and Mind History* included some of these papers. I am one of the editors of a new journal, *Culture and Psychology*, which recently published an issue on history and national identity. This material is very much motivated by the same kind of theoretical framework. *Culture and Psychology* and another new journal, *Mind, Culture and Activity*, are heavily influenced by the Vygotsky tradition.

Dr. Wertsch, thanks for sharing your perspectives and pointing out these wonderful resources for our readers. ❐

James V. Wertsch is Professor and Chair of the Department of Education at Washington University in St. Louis, Missouri. **Brenda Fyfe,** Professor of Education at Webster University, is a member of the Board of Directors of the Association for Constructivist Teaching.

For further reading:

Cole, M. (1996). *Cultural psychology: A once and future discipline*. Cambridge, MA: Harvard University Press.

Hatano, G., Amaiwa, S., & Shimizu, K. (1987). Formation of a mental abacus for computation and its use as a memory device for digits: A developmental study. *Developmental Psychology, 23*, 832-838.

Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context*. New York: Oxford University Press.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Vygotsky, L. S. (1987). *The collected works of L.S. Vygotsky. Volume 1. Problems of general psychology. Including the volume Thinking and speech*. New York: Plenum.

Wertsch, J. V. (1985). *Vygotsky and the social formation of mind*. Cambridge, MA: Harvard University Press.

Wertsch, J. V. (1991). *Voices of the mind: A sociocultural approach to mediated action*. Cambridge, MA: Harvard University Press.

Wertsch, J. V. (In press). *Mind as mediated action*. New York: Oxford University Press. ❐

Note: This readings list is reprinted from Part I of the interview, which appeared in the Fall 1996 issue of *The Constructivist*.

Teaching to Facilitate "Progressive Schematization" or Reflective Abstraction?

Constance Kamii, Faye B. Clark, and Ann Dominick

***Constance Kamii and her colleagues take issue with the theoretical interpretations offered by Dolk, Uittenbogaard, and Fosnot in an article that appeared in the Summer 1996 issue of* The Constructivist.**

Figure 1.
Increasingly efficient ways of computing 78 ÷ 6 by subtraction

78	78		78	
–6	–12	2	–60	10
72	66		18	
–6	–12	2	–18	3
66	54		0	13
–6	–12	2		
60	42			
–6	–12	2		
54	30			
–6	–12	2		
48	18			
–6	–12	2		
42	6			
–6	–6	1		
36		13		
–6				
30				
–6				
24				
–6				
18				
–6				
12				
–6				
6				
–6				
0				

In "Teaching to Facilitate Progressive Schematization," Dolk, Uittenbogaard, and Fosnot (1996) rightly pointed out that constructivism is not a theory about teaching. We agree that it is a theory about learning, although we would say that it is about development and learning. The authors concluded their article by saying, "Our present reform initiative . . . will once again fail if we interpret constructivist teaching simply as pedagogical strategies and do not take seriously constructivism as a cognitive learning theory" (p. 14).

We take constructivism seriously as a scientific theory about how children learn. We therefore feel the need to clarify Piaget's theory. Dolk et al. began their article by saying that, according to constructivism, learning is a developmental process of conceptual reorganization. They went on to state that "this conceptual reorganization most often occurs in one of two forms" (p. 10). The first form involves a structural change and reflective abstraction, but the second form does not according to Dolk et al. The second form involves only "the refinement of a *scheme*, defined as an organized pattern of behavior (Piaget, 1977a)" (p. 10). The authors call this second form of conceptual reorganization "progressive schematization" and titled their article "Teaching to Facilitate Progressive Schematization."

We have been studying Piaget's constructivism for some time and find contradictions between Piaget's theory and Dolk et al.'s interpretation of this theory. We decided to respond to their article because different explanations of how children learn lead to differences in how we teach children in the classroom. We begin by examining Dolk et al.'s notion of "progressive schematization."

Does Multiplication Occur by "Progressive Schematization?"

The example Dolk et al. give of "progressive schematization" is the computation of 78 ÷ 6 with increasing efficiency (see Figure 1). We agree that the least efficient way is repeated

Different explanations of how children learn lead to differences in how we teach children.

subtraction of sixes. We also agree that a more efficient way is the repeated subtraction of twelves, and that an even more efficient way is to subtract ten groups of sixes and then three more groups.

While we are in general agreement with this progression, we think that repeated subtraction as in Figure 1 is an adult view of division. All the children presented by Dolk et al. (1996) solved division problems with repeated addition and multiplication. As can be seen in Kamii (1990a, 1990b, 1994), the children we work with usually solve division problems with repeated addition and multiplication. Olivier, Murray, and Human (1991) likewise observed that children in South Africa use addition and multiplication strategies to solve division problems.

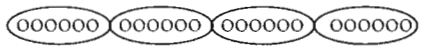
According to Dolk et al., reflective abstraction is *not* involved in this "progressive schematization." However, this statement is contrary to Piaget's view. Piaget often wrote about reflective abstraction but never about "progressive schematization" as far as we know. He distinguished between *empirical* abstraction and *reflective* abstraction (Piaget, 1977b), and pointed out that, in empirical abstraction, we abstract certain properties (such as color) from objects and ignore others (such as weight). In reflective abstraction, by contrast, the abstraction is from our (mental) actions, and reflective abstraction is involved in all mental activities, from infancy onward (Piaget, 1937/1954).

An example of reflective abstraction can be seen in the child's construction of number concepts. In numerical quantification, the child puts objects into numerical relationship, and the properties of the objects are irrelevant. Six pieces of candy and six elephants are both *six*. The abstraction of number concepts is not *from* the objects. Number concepts are abstracted from the child's mental action on the objects. When the child later combines two numbers, addition also involves reflective abstraction. When multiplication such as "two times six" becomes possible, this progress is made through reflective abstraction out of addition.

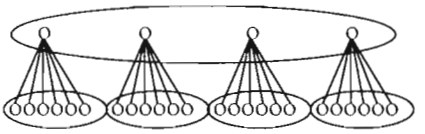
Many teachers and mathematics educators think that multiplication is repeated addition made more efficient. For Piaget (1977b, 1983/1987), Steffe (1988, 1992), and us (Clark & Kamii, 1996), however, multiplication involves not the reorganization or refinement of an existing scheme but the construction of a new scheme, new number concepts, and a new structure, through reflective abstraction. As shown in Figure 2a, the structure of repeated addition such as 6 + 6 + 6 + 6 is simple because repeated addition involves only *ones* at one level of abstraction. Multiplication such as 4 x 6, on the other hand, involves a hierarchical structure (see Figure 2b). It can be seen in Figure 2b that the "4" in 4 x 6 is not the same kind of number as the *ones*. To get from thinking 6 + 6 + 6 + 6 to thinking 4 x 6 requires the construction of new, *higher-order numbers* out of addition. In other words, the progress from repeated addition to multiplication requires the *construction* of new elements, through reflective abstraction, rather than the mere *reorganization* of elements

Figure 2.
The structural difference in thinking between (a) repeated addition and (b) multiplication

(a) 6 + 6 + 6 + 6



(b) 4 x 6



that already exist.

Skeptics may say that the distinction between repeated addition and multiplication is just theoretical speculation. To show that this distinction is based on facts, we present evidence from a study conducted with 336 students in grades one through five at a public school in a middle-income neighborhood near Birmingham, Alabama (Clark & Kamii, 1996).

A Task Teachers Can Use to Observe Multiplicative Thinking

In this study, we showed three "fish" (eels) and 50-100 chips to the child. The "fish," illustrated in Figure 3, were 5, 10, and 15 cm long. The procedure was the following:

1. The child was told, "This fish (pointing to B) eats 2 times what this fish (pointing to A) eats, and this big fish (pointing to C) eats 3 times what the little one (pointing to A) eats. This fish (B) eats 2 times what this fish (A) eats because it is 2 times as big as this one (A)." The interviewer demonstrated by showing that A could be placed on B two times. The interviewer continued, "The big fish (C) eats 3 times what the little fish (A) eats because it (C) is 3 times as big as this one (A)." The interviewer again demonstrated by placing A on C three times.
2. The first question was then posed: "If this fish (A) gets 1 chip of food, how many chips of food would you feed the other two fish? . . . The following similar questions were then posed:
   a. When B received 4 chips
   b. When C received 9 chips
   c. When A received 4 chips
   d. When A received 7 chips
3. If a child answered item b incorrectly, a counter-suggestion was offered: "Another boy/girl told me that if this big fish (C) gets 9 chips, the little fish (A) should get 3 chips because 9 (pointing to the 9 chips rearranged into three groups of 3) is 3 times what this is (pointing to the 3 chips given to A and arranged in one group). And this fish (B) should get 6 chips because 6 (pointing to 6 chips rearranged into two groups of 3) is 2 times what this is (pointing to the 3 chips given to A). What do you think of his/her idea?" After the child gave an opinion, the interviewer asked for an explanation: "Why do you think your way (or the other person's way) is better?" To avoid suggesting the multiplication tables, care was taken to say, "Nine is 3 times what *this* (A's chips) is," rather than "Nine is 3 times what *three* is."

It can be observed in Table 1 that Level IVB, called *multiplicative thinking with immediate success*, was demonstrated by only 22%, 28%, and 49% of the third, fourth, and fifth graders, respectively. Almost half of the third (42%), fourth

Figure 3.
The fish (eels) used in the task

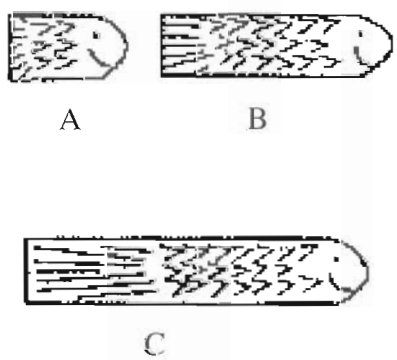


Table 1.
Percentage of Children at Each Developmental Level by Grade

Level	Grade 1	2	3	4	5
IVB	1.7	9.2	22.0	28.2	48.7
IVA	17.2	35.4	42.4	53.8	42.1
III	13.8	10.8	22.0	2.6	2.6
II	53.4	43.1	13.6	15.4	6.6
I	13.8	1.5			

(54%), and fifth graders (42%) were found to be at Level IVA, called *multiplicative thinking but not with immediate success*. Almost all the children in this category were those who benefited from the counter-suggestion in which a multiplicative solution was demonstrated.

The children at Levels II and III remained additive even after the counter-suggestion. A typical example of Level II (*additive thinking with a numerical sequence of +1 or +2*), is to give 5 chips to B if A received 4, and 6 chips to C. A typical example of Level III (*additive thinking involving +2 for B and +3 for C*) is to give 6 chips to B if A received 4, and 7 chips to C. The children at Level III explained that they gave 6 to B because 4 + 2 = 6, and that they gave 7 to C because 4 + 3 = 7. Level III is especially instructive because it demonstrates that if children cannot think multiplicatively, they understand "2 times" as "2 more," and "3 times" as "3 more." In Piagetian terms, if children do not have a multiplication scheme, they assimilate "2 times" to the scheme they have, which is the addition scheme.

The "fish" task was chosen because it was an easy task for the following reasons:

1. It involved small, easy multipliers such as "2 times," and "3 times."
2. It let the child show multiplicative thinking with actions (by making two groups of four and three groups of four, for example) without having to give numerical answers (such as "eight" and "twelve").
3. It included a counter-suggestion that demonstrated the correct multiplicative solution.

It can be observed in Table 1 that many third, fourth, and fifth graders were found to be at Levels II and III, and not yet capable of multiplicative thinking. The percentages who demonstrated only additive thinking were approximately 36% in third grade, 18% in fourth grade, and 9% in fifth grade.

We thus conclude that multiplication is not the mere reorganization or refinement of the addition scheme. Multiplication involves the construction of a new, higher-order scheme out of addition. Furthermore, we maintain that the "search for efficiency" *does* involve reflective abstraction. In short, the notion of "progressive schematization" contradicts Piaget's theory. For us, therefore, the teacher's job is not to facilitate "progressive schematization" but to facilitate the construction of multiplication, by reflective abstraction.

Pedagogical Implications

Dolk et al. (1996) criticize our way of teaching and recommend providing children with models and encouraging them to discuss the efficiency of various learner-generated strategies. We do suggest more efficient strategies but in the form of saying, "Another child did it this way. . . . What do you think of his (or her) way?" We also use problems such as "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?" (p. 12). However, we first determine which children are "ready" to be pushed toward more efficient strategies and higher levels of reasoning. We also encourage children to push themselves from within.

Figure 4 shows the relationship between the computation procedures children use in class (addition or multiplication) and whether or not they are capable of multiplicative thinking (as demonstrated in the "fish" task). If children cannot think multiplicatively in an easy task like the "fish" task, multiplication may simply not make sense to them. This is why we wrote, "May need to use addition" in the two bottom cells concerning children at Levels II and III. Addition may seem inefficient to adults, but this may well be the most efficient way for a child who needs to write "6 + 6 + 6 + 6 . . ." to make sense of what he or she is doing.

A way to encourage additive thinkers (Levels II and III) to become multiplicative is to give problems such as 4 x 25 and 5 x 20. Certain numbers are more familiar (because four quarters make a dollar) or "friendlier"

Figure 4.
Multiplicative and additive thinkers who may or may not be pushed to use multiplication

	Computation in class: Addition	Computation in class: Multiplication
Multiplicative thinkers (Levels IVA and IVB) on the fish task	May be pushed to use multiplication	No need to push to use multiplication
Additive thinkers (Levels II and III) on the fish task	May need to use addition	May need to use addition

than others. These combinations are much more conducive to multiplicative thinking than the multiplication of six.

Among those who are at Levels IVA and IVB, some are already using multiplication and do not need to be pushed to use it. Others continue to use addition because this is easier for them. We wrote "May be pushed to use multiplication" for this group. As can be seen in Kamii (1994), a good way to push this group is to say, "I want you to think about the fastest way to do 81 ÷ 6. Try to do the whole thing in your head if you can. If you can't, I want you to think hard about the fastest way before you pick up your pencil and start writing. You may save yourself a lot of work by thinking of a fast way first." Some third graders surprise themselves by solving the problem entirely in their heads.

An important principle we follow is to work on multiplication so that children will use it in dealing with division problems. It is easy for many third graders to remember 3 x 10 = 30, 4 x 10 = 40, 5 x 10 = 50, etc., while playing games. Those who have this knowledge solidly are likely to use it to compute 81 ÷ 6.

How much to push children and *how* are questions of *pedagogy*, educational research, and the art of teaching. By contrast, whether or not multiplication is a more efficient way of doing repeated addition is a question of *science*.

The purpose of science is to describe and explain phenomena. A scientific theory only describes and explains a phenomenon, but it can make an enormous difference in an applied field like education. To take an example from medicine, physicians change their practice when a new scientific explanation is found. Educators must likewise change their practice when learning is explained better with a more adequate scientific theory. A scientific theory does not automatically inform pedagogy, but it enables us to debate pedagogical issues on scientific grounds.

In Conclusion

We hope *The Constructivist* will become a forum for the exchange of viewpoints like this one. Our debate must separate the scientific description and explanation of learning and development from pedagogical issues. Pedagogical debates are important, too, but, if we do not clarify the scientific theory first, we have nothing to offer to each other except opinions. As Dolk et al. rightly insist, we must take constructivism seriously as a scientific theory of cognitive development.

Speaking of humanity's construction of science, Piaget (1980) said,

> The confrontation of points of view is already indispensable in childhood for the elaboration of logical thought, and such confrontations become

A scientific theory does not automatically inform pedagogy, but it enables us to debate pedagogical issues on scientific grounds.

increasingly more important in the elaboration of sciences by adults. Without the diversity of theories and the constant search for going beyond the contradictions among them, scientific progress would not have been possible. (p. vii) ❐

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References

Clark, F., & Kamii, C. (1996). Identification of multiplicative thinking in children in grades 1-5. *Journal for Research in Mathematics Education*, 27, 41–51.

Dolk, M., Uittenbogaard, W., & Fosnot, C. T. (1996). Teaching to facilitate progressive schematization. *The Constructivist*, *11*(1), 10–14.

Kamii, C. (1990a). *Multidigit division: Two teachers using Piaget's theory* [videotape]. New York: Teachers College Press.

Kamii, C. (1990b). *Multiplication of two-digit numbers: Two teachers using Piaget's theory* [videotape]. New York: Teachers College Press.

Kamii, C., with Livingston, S. J. (1994). *Young children continue to reinvent arithmetic, 3rd grade*. New York: Teachers College Press.

Olivier, A., Murray, H., & Human, P. (1991). Children's solution strategies for division problems. In R. G. Underhill (Ed.), *Proceedings of the Thirteenth Annual Meeting*, North American Chapter of the International Group for the Psychology of Mathematics Education (Vol. 2, pp. 15–21). Blacksburg, VA (Virginia Tech).

Piaget, J. (1954). *The construction of reality in the child*. New York: Basic Books. (Original work published 1937)

Piaget, J. (1977a). *The development of thought: Equilibration of cognitive structures*. New York: Viking Press.

Piaget, J. (1977b). *Recherches sur l'abstraction reflechissante, Vol. 1, L'abstraction des relations logico-arithmetique* [Research on reflective abstraction, Vol. 1, Abstraction of logico-arithmetical relationships]. Paris: Presses Universitaires de France.

Piaget, J. (1980). Foreword. In C. Kamii & R. DeVries, *Group games in early education: Implications of Piaget's theory* (p. vii). Washington, DC: National Association for the Education of Young Children.

Piaget, J. (1987). *Possibility and necessity*. Minneapolis: University of Minnesota Press. (Original work published 1983)

Steffe, L. (1988). Children's construction of number sequences and multiplying schemes. In J. Hiebert & M. Behr (Eds.), *Number concepts and operations in the middle grades* (Vol. 2, pp. 119–140). Reston, VA: National Council of Teachers of Mathematics.

Steffe, L. (1992). Schemes of action and operation involving composite units. *Learning and Individual Differences*, 4, 259–309.

Letters to the Editors

The editors of *The Constructivist* want your feedback! Please send all Letters to the Editors to Catherine Twomey Fosnot, The City College of New York, NAC 3/209a, 138th Street and Convent Avenue, New York, New York 10031.

Classified Ads

Educational Opportunities/ Job Market

To list your educational opportunities or post a job announcement, contact Sharon Schattgen at the Project Construct National Center, (800) 335-PCNC, University of Missouri-Columbia, 27 South Tenth Street, Columbia, Missouri 65211.
Fax: [573] 884=5580.
E-mail: ACT@projectconstruct.org.

The Role of Context in Mathematics Learning: Reply to Kamii, Clark, and Dominick

Catherine Twomey Fosnot and Maarten Dolk

Catherine Fosnot and Maarten Dolk respond to Kamii, Clark, and Dominick, noting points of agreement and clarifying differences.

We are pleased to have this opportunity to reply to Kamii, Clark, and Dominick (1997) and to clarify our position on progressive schematization, construction, and the role of context in learning. We are in agreement with Kamii et al. on several points. Our main point of disagreement is on the role of context.

Our main point of disagreement is on the role of context.

The Role of Subtraction in Division

First, we agree that children almost always use repeated addition over repeated subtraction in solving division problems. The data from the "parent's evening problem" that we shared in our article, "Teaching to Facilitate Progressive Schematization" (Dolk, Uittenbogaard, & Fosnot, 1996), clearly shows the progression of children's strategies from counting by ones, to skip counting by sixes, to repeated addition of sixes, to the use multiplication in taking ten groups of sixes at once—although the problem is a division one: How many tables shall we set out if 81 parents are coming, and we seat them six to a table? In our introduction in the article, we did use the progression of repeated subtraction, and its eventual refinement of taking out ten groups all at once, as an example of progressive schematization. Perhaps it would have been a better choice (as Kamii et al. point out) to use repeated addition because it is more common, given the problems usually posed to children.

Subtraction does occur though, even though it is rarer. And here the reader can perhaps see the critical role of context and the subsequent role of the teacher in using context when designing problems or investigations. A context that requires keeping track will more likely elicit subtraction than addition. The following problem is an example:

> My metrocard had $36.50 on it when I went through the gate. I noticed that the monitor read $35 afterwards, so I know that each time I go through the gate for a subway my card is charged $1.50. I thought that I should keep a record at home of how much I am

using, but I am afraid that I will forget sometimes to write it down. How many trips can I take before I have to put more money on the card?

Perhaps it is because New York City children know that the monitor subtracts the amount and shows what remains and that this action, so inherently connected to the context, causes them to subtract. Whatever the reason, some children who use addition in other division problems will use subtraction here.

The choice of numbers by the teacher can also produce an interplay between subtraction and addition strategies within the same problem. In a bare structured string of problems with no context, we have found children to use a combination of strategies. For example, see the string in Figure 1.

Children most often begin this string by adding up tens or using what they know about the pattern of multiplying by ten to solve the first three problems. The next two problems bring the commutative property to the surface. Even if children don't employ the commutative property and use instead repeated addition, they see a pattern in their answers and can then investigate whether the commutative pattern will always hold. As they continue through the string discussing their answers and strategies, they use the patterns they discovered in the beginning to solve the remaining problems, and here they use a combination of subtraction and multiplication, saying most often, "4 times 100 is 400, I have 68 left; 4 times 10 is 40, I have 28 left; 4 times 7 is 28; 100 + 40 + 7 = 147." For the last one, they often say, "41 times 10 is 410, I have 58 left, that is one more 41, with 17 left." Subtraction is employed to keep track and to deal with the remainder.

We have also seen children use subtraction as a way to keep track, even when we didn't expect it and weren't trying to elicit it. For example, at the Derby Ridge Elementary School in Columbia, Missouri, fourth graders were investigating how the teacher's friend had made $328 selling Sega games for $8 apiece at a tag sale. They

Figure 1.
A string to elicit the distributive strategy employing tens

140 ÷ 10 =
120 ÷ 10 =
320 ÷ 10 =
120 ÷ 12 =
320 ÷ 32 =
460 ÷ 46 =
400 ÷ 4 =
460 ÷ 4 =
468 ÷ 4 =
468 ÷ 41=

Figure 2.
Two children's repeated subtraction chart

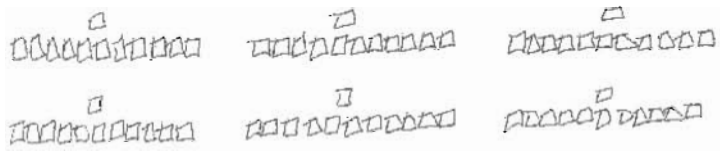
328	240	152	64
–8	–8	–8	–8
320	232	144	56
–8	–8	–8	–8
312	224	136	48
–8	–8	–8	–8
304	216	128	40
–8	–8	–8	–8
296	208	120	32
–8	–8	–8	–8
288	200	112	24
–8	–8	–8	–8
280	192	104	16
–8	–8	–8	–8
272	184	96	8
–8	–8	–8	–8
264	176	88	
–8	–8	–8	
256	168	80	
–8	–8	–8	41 games
248	160	72	
–8	–8	–8	
240	152	64	

were very invested and grounded in the context with this problem because the teacher's friend had sold them at such a cheap price! Many exclaimed how they wished they had been there! Although one would expect this context to elicit repeated addition strategies, and in most cases it did, two children in the class of 24 used repeated subtraction of eights. See Figure 2. When asked why they had decided to subtract, the two children explained that they wanted to keep track as they went along because $328 was so much money. The connection between another child's chart showing skip counting by eights and their subtraction work was a "big idea" pursued in the discussion at the math congress by the teacher. We call this a big idea because it involves part/whole relations—the construction of an important structure for multiplication and division. Understanding that you can go forward (addition) or reverse the actions (subtraction), yet the whole remains the same, involves the reversibility of which Piaget wrote so aptly.

Unitizing or Higher-Order Numbers in Multiplication

Kamii et al. point out that multiplicative reasoning is different than simple repeated addition. We agree that multiplicative reasoning is different than simple repeated addition, when the child is simply counting by ones, counting on, or *using skip counting*. But when the child uses, say, a six to represent a group and *simultaneously* calls it one, one group of six, she is unitizing the group. Number in this case is being used both to count the objects in the group as well as the group. This is a major big idea of multiplication. The same kind of thinking is involved in understanding place value, when a child represents 10 objects as one ten. A child who represents 6 Lifesaver packs of 11, each as 11 + 11+ 11+ 11 +11 +11 = 66, is using number differently than a child who uses two sets of cubes, one set for the packs and one set for the 11 candies in each pack, or than a child who draws each pack with the candies also drawn inside. See Figure 3. These last two children need to represent the objects and the packs and then count or add each. The first child is able to simultaneously consider how the 11 can represent the pack and the candies. To us, this is the hallmark of multiplicative thinking. Although he may fall back on an addition strategy to get the answer, we believe this is only because the child's repertoire of familiar facts has not yet been built, and, therefore, can not be used. Even more clearly, when a child doubles 11 and counts it as 2 times 11 and then does this three times to complete 6

Figure 3.
Two children's strategies for the Lifesaver problem



6 packs with 11 candies in each

6 packs with 11 candies in each

We believe that learning is a case of refining schemes *and* grappling with big ideas. *Both* are construction, and both affect each other reciprocally.

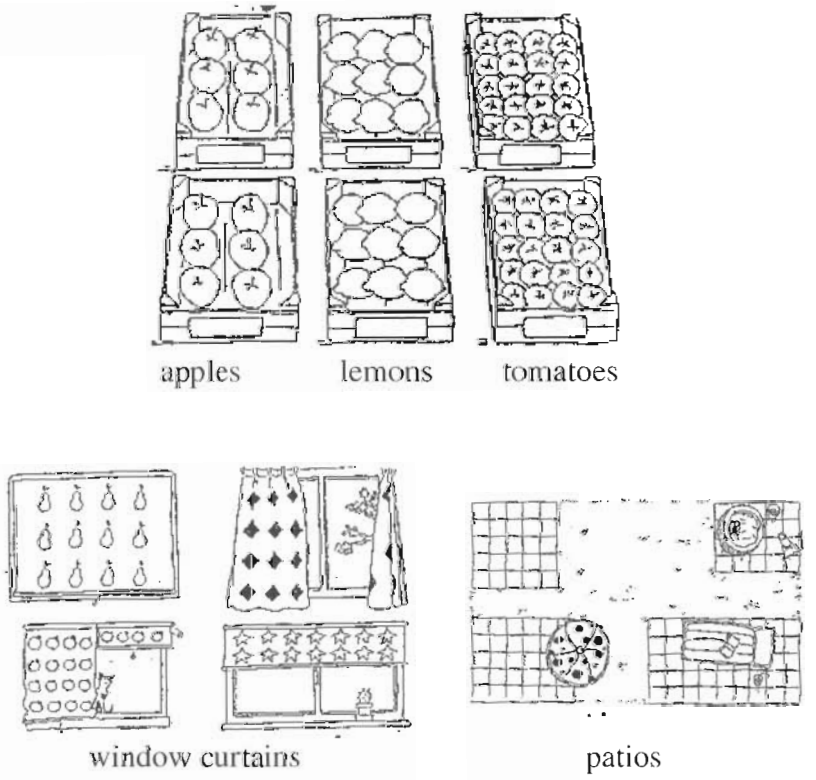
groups of 11, she is unitizing number. And when children figure out 7 times 16 by working with what they know first, such as (7 x 5) + (7 x 5) + (7 x 5) + 7 = 35 + 35 + 35 + 7, they are unitizing. Solving the same problem by using 10 x 7 and then 6 x 7 is simply a refinement, or *progressive schematization*, of the unitizing in the prior solution. The *big ideas* here are the distributive property, the commutative property, and unitizing, all of which are connected to the part/whole relations, thus a structure. The strategies used are schemes that are representative of the structures constructed. Thus, the interplay between schemes and structures can be seen in action as children construct strategies to multiply.

We believe that this analysis is very much based on Piaget's work, since he described this interplay between structures and schemes (Piaget, 1977). Further, he wrote of at least two kinds of disequilibrium which both engender reflective abstraction: One type is when the scheme is seen as insufficient by the learner, a second type is when two contradictory ideas are held and eventually become seen as a paradox by the learner. Kamii et al. criticize us for saying that only big ideas require reflective abstraction. We did not intend to imply this. We believe that learning is a case of refining schemes *and* grappling with big ideas. *Both* are construction, and both affect each other reciprocally. The importance of this knowledge for teachers is to enable them to design contexts which will bring to the surface big ideas for discussion and investigation, contexts which because of built-in constraints will suggest a search for more efficient schemes, and contexts employing various models which will broaden the employment of the assimilatory scheme, for multiplication this means using problems which involve not only repeated addition, but arrays, area, volume, combinations, and stick/shadow ratio problems.

The Role of Context

When we work with teachers, we help them begin to appreciate the importance of context. Employing the use of pictures like those in Figure 4 will produce different strategies than simple word problems because of the built-in constraints. For

Figure 4.
Pictures with constraints built into the context



example, if children are asked how many apples, lemons, or tomatoes are on the grocery shelf and are shown the corresponding pictures, they can count, count on, or use repeated addition strategies. However, the second problem (how many shapes are on the curtains) and its corresponding pictures may facilitate disequilibrium to a counting scheme because the second curtain is not shown open. Of course, children who really need to count can use the open curtain and count it twice, but many children will construct a new strategy employing doubles: $(4 \times 3) + (4 \times 3) = 8 \times 3$. When asked how many tiles are in the patio and shown the corresponding pictures, many children will employ a distributive strategy using groups of ten. Because the beach umbrella covers two rows of tiles on the bottom left patio, thus restricting a counting scheme, children are likely to use the distributive property to determine the number of tiles in this particular patio: $6 \times 5 = (4 \times 5) + (2 \times 5)$. Teachers who are aware of the developmental progression of strategies can use contexts such as these to bring to the surface new schemes and big ideas for discussion.

It is this use of contexts with constraints, rather than simple word problems, that is perhaps our main disagreement with Kamii et al. They state,

> We do suggest more efficient strategies but in the form of saying, 'Another child did it this way. . . . What do you think of his (or her) way?' We also use problems . . . However, we first determine which children are 'ready' to be pushed toward more efficient strategies and higher levels of reasoning. We also encourage children to push themselves from within. (p. 12)

To us, this sounds more like maturationism than constructivism—assess and then prescribe, relying on development. Constructivism is an interactionist theory—the individual *interacts* with the environment. The environment is more than just the social discussion of agreement and disagreement, although this is certainly a part of it. It is also the problems one meets. In trying to assimilate new problems with current schemes, disequilibrium is engendered and new schemes (and structures) are constructed.

We tried to bring this point out in our article on progressive schematization because we are concerned with what we have seen in many classrooms in which teachers are trying to base their practices on the mandate for reform. Conventional algorithms are not explicitly taught so that more understanding occurs. We believe (in agreement with Kamii et al.) that this is a good choice, but many children are often left with only repeated addition or subtraction strategies for multiplication and division because teachers do not know how to stretch these schemes into higher level, more efficient strategies. Enabling children to look to the numbers for a "most efficient" strategy is an important goal as we develop number sense, and teachers need to be aware of how to employ context as a tool.

And finally, while context is important as a pedagogical tool, it is also important for researchers to consider in assessing children's understanding. Kamii et al. describe the results of a fish-eating task as proof of the difficulty in constructing multiplicative reasoning. While we agree with her point that multiplicative reasoning requires unitizing or the use of higher order numbers (as we discussed earlier in this article), we do not agree that her task assesses it. To us, it is a "researcher's" problem and probably makes little sense to most young children. Just because a fish is three times bigger than another fish, in the

Constructivism is an interactionist theory—the individual *interacts* with the environment. The environment is more than just the social discussion of agreement and disagreement . . .

real world it does not necessarily eat three times as much. Children exist in a world where they see adults as often two or three times larger than they are, but these adults do not necessarily eat multiplicatively two or three times more, although they do eat additively more. The fish task requires knowledge of what the word "times" means, as well as the giving up of "contextual" meaning to perform the task with the adult abstraction of proportional reasoning. We are not surprised by the results Kamii et al. found, since the data probably represent children's attempts to make sense of a non-sensical situation. As they get older and more accustomed to school-like tasks, as well as the language of times, they are more willing to sacrifice their own meaning and perform in "school-like" ways.

Conclusion

While we have tried in this response to clarify our position relative to that of Kamii and her colleagues, we also hasten to add that we believe their work in allowing children to construct their own strategies as they calculate has been exemplary in moving the field of mathematics pedagogy to its current reform state. When children are allowed to take number apart and calculate in their own invented ways, they are empowered, understand more conceptually, and begin to function as mathematicians. ❐

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References

Dolk, M., Uittenbogaard, W., & Fosnot, C.T. (1996). Teaching to facilitate progressive schematization. *The Constructivist, 11*(1), 10–14.

Kamii, C., Clark, F., & Dominick, A. (1997). Teaching to facilitate "progressive schematization" or reflective abstraction? *The Constructivist, 12*(1), 9–14.

Piaget, J. (1977). *The development of thought: Equilibration of cognitive structures*. New York: Viking Press.

Preliminary Program*

Annual Conference of the Association for Constructivist Teaching

November 14–15, 1997
New York, New York
co-sponsored by
The City College of the City University of New York

Friday, November 14, 1997

8:00 a.m.–9:00 a.m. Registration and Reception

9:00 a.m.–10:30 a.m. **WELCOME AND KEYNOTE ADDRESS**

The Role of Context in Mathematics Learning
Catherine Twomey Fosnot, City College of New York

10:45 a.m.–12:15 p.m. **SESSION I WORKSHOPS** (concurrent)

IA Using Contexts in Teaching Geometry
Maarten Dolk, Freudenthal Institute, The Netherlands

IB Helping Children Invent Their Own Math Games
Carolyn Hildebrandt, University of Northern Iowa

IC Playing with Light: Discussion on Teaching and Researching through Exploratory Activities with Materials and Nature
Elizabeth Cavicchi, Fiona Hughes-McDonnell, and *Petra Lucht*, Harvard Graduate School of Education

ID The Role of Context in Language Learning: Application to Second-Language Teaching and Bilingual Classrooms
Ricardo Otheguy, City College of New York, *Alan Huffman*, New York Technical College, *Wallis Reid*, Rutgers University, and *Lorraine Teller*, Essex County Vocational-Technical Schools

IE Fear of Failing: How Can We Let Children Be Autonomous Learners?
Sally Pena, Idaho State University, *Judy French*, Boise State University, *Tammi Utter* and *Teresa Bala*, Sunnyside Elementary School, Idaho Falls, Idaho

IF Teacher Inquiry: Professional Learning through Constructing and Conducting a Classroom-Based Research Study
Beverly Falk, City College of New York and Teachers College, Columbia University

IG Are Constructivism and Conceptual Change Theory Compatible?
Klaus Schultz, University of Massachusetts-Amherst

12:15–1:30 p.m. **LUNCH** (on your own)

1:45–3:15 p.m. **SESSION II WORKSHOPS** (concurrent)

IIA Constructivism and Teaching Mathematics: What Can Be Learned from Research? (3 hour workshop)
Carolyn Maher, Rutgers University, *Emily Dann*, City College of New York

IIB Using Reggio-Emilia Videotapes in Preservice Teacher Education
Myrna Packard, University of Wisconsin-Milwaukee

IIC Explorations: Opportunities for Constructing Meaning
Carol Lauritzen and *Michael Jaeger*, Eastern Oregon University

IID Analysis and Design of Everyday Things
Gary Benenson and *Jim Neujahr*, City College of New York

IIE Assessment of Constructivist-based Mathematics Teaching (tentative)
Marja van Heuvel-Panhuizen, Freudenthal Institute, The Netherlands

IIF Bridging the Gap: Constructing Knowledge through Exploring the Built Environment (3 hour workshop)
Alan Feigenberg, City College of New York

IIG Examining Learning
Frank Smith, University of Victoria

3:30–5:00 p.m. **SESSION III WORKSHOPS** (concurrent)

IIIA Exploring Potatoes and Eggs: Science through Inquiry
Susan Rauchwerk, Massachusetts Audubon Society and Harvard Graduate School of Education

IIIB The Connections Project: Strengthening Learning through Technology-based Integrated Curriculum and Professional Development
Neal Topp, *Lawrence Bundy* and *Maria Dowse*, Nebraska State Department of Education

IIIC Maneuvering Road Blocks to Constructivist Math
Teresa Scherpinski and *Anne Solomon*, Under Construction, Inc., Salinas, California

IIID Exploring and Facilitating Early Number Construction through the Use of Contexts and Games
Betina Zolkower, City College of New York, *Julie Rosemarin*, P.S. 41, New York City, and *Madeline Chang*, P.S. 234, New York City

IIIE (Workshop IIA continues, Maher and Dann)

IIIF (Workshop IIF continues, Feigenberg)

5:15–6:30 p.m. **KEYNOTE ADDRESS**
Learning and Forgetting
Frank Smith, University of Victoria

6:30 p.m. **RECEPTION** (Wine and Cheese)
City College Jazz Ensemble

Saturday, November 15, 1997

9:00–10:30 a.m. **KEYNOTE ADDRESS**
Theory to Practice: A Way to Look at Discourse in the Classroom (co-sponsored by the Jean Piaget Society)
Irving Sigel, Educational Testing Service

10:45 a.m.–12:15p.m. **SESSION IV WORKSHOPS** (concurrent)

IVA Using Contexts to Teach Multiplication
Willem Uittenbogaard, Freudenthal Institute, The Netherlands, *Peter Markovitz*, River East Elementary, New York City, *Holly Freeman*, CSD #2, New York City

IVB What, If Anything, Is Constructivist Teaching?
Michael Filisky, Hsueh Yeh, and *Marianne Nelson*, Harvard Graduate School of Education

IVC Habitats From Their View: Children Constructing Knowledge
Lisa Merideth, Derby Ridge Elementary, Columbia, Missouri, and *Libby Robinson*, Midway Heights Elementary, Columbia, Missouri

IVD Learning about Learning: How Children Teach Us about Quest for Meaning
Jacqueline Grennon-Brooks, State University of New York at Stonybrook

IVE Science Inquiry: Opening the Journey
Rebecca Dyasi, Mitch Bleier, City College of New York

IVF Examining Learning (Repeat of IIG workshop)
Frank Smith, University of Victoria

IVG Building a Mental Model of the Sun/Earth/Moon System
Ellen Goldstein, City College of New York

12:30–3:00 p.m. **LUNCHEON** and **KEYNOTE ADDRESS**
(cost included in registration)
Beyond Discipline: Developing a Community of Learners
Alfie Kohn, Educational Consultant

3:15 p.m.–4:45 p.m. **SESSION V WORKSHOPS** (concurrent)

VA Math Learning and Equity
Jessie Auger, King Open School, Cambridge, Massachusetts

VB Integrating a Focus on Social and Moral Development in Teacher Education: What Might a Constructivist Approach Look Like?
Linda Kroll, Mills College, *Carolyn Hildebrandt*, University of Northern Iowa, *Lettie Ramirez*, California State University at Hayward, *Marilyn Watson*, Developmental Studies Center

VC Upper Elementary Grade Fraction Concepts: Realistic Constructive Investigations
Emily Dann, City College of New York, *Sadie Caldwell-Crenshaw*, P.S. 161, New York City, *Ellen Foote*, CSD #2, New York City

VD A Peer Coaching Model to Support Constructivist Teachers
Laura Knoesel and *Laurie Kingsley*, Derby Ridge Elementary, Columbia, Missouri

VE Zine Projects for Intermediate Grades
Liala Strotman, Miller Avenue Elementary, Shoreham, New York

VF Examining Learning (Repeat of IIG and IVF workshops)
Frank Smith, University of Victoria

VG Beyond Counting: The Teacher's Role in Supporting Children's Ongoing Arithmetical Development
Nancy Knipping, Sue Novinger, and *Joy Whitenack*, University of Missouri-Columbia

Note: Conference sessions will be held in the North Academic Center of City College of New York, which is located at 137th Street and Convent Avenue. Convent Avenue runs parallel to Amsterdam Avenue, which is a main thoroughfare in Manhattan. Use Subways 1 (137th Street/City College stop), 9 (137th Street/City College stop), or A (145th Street stop), or take a New York City taxi.

ANNUAL CONFERENCE OF THE ASSOCIATION FOR CONSTRUCTIVIST TEACHING

November 14–15, 1997
City College of New York
New York City

REGISTRATION FORM

Send completed form and check to: Cathy Fosnot, ACT, City College of New York, NAC 6/207 138th Street and Convent Avenue, New York, New York 10031

Checks should be made payable to the Association for Constructivist Teaching.

Name _____

Affiliation _____

Position _____

Preferred Mailing Address _____

City _____ State _____ Zip _____

Tel _____

	Member		Non-Member	
	Pre-Paid*	On-Site	Pre-Paid*	On-Site
Registration fee per person	$95.00	$115.00	$110.00	$130.00
Student	#30.00	$30.00	$30.00	$30.00

Total enclosed $_____
Non-refundable
* Deadline for pre-paid registration is **Oct. 16, 1997**

Registration includes Friday evening reception and Saturday lunch.
Overnight accommodation not included. Please contact hotels directly.

Annual Conference of the Association for Constructivist Teaching

November 14–15, 1997
City College of New York, New York City

Lodging Information

Overnight accommodations are available at:

Hotel Beacon
2130 Broadway
@ 75th Street
New York, NY 10023
Tel: 212-787-1100
Fax: 212-724-0839
Twin Suites: $140.00
Deadline Oct. 16th

Radisson Empire Hotel
44 West 63rd Street
New York, NY 10023
Tel: 212-265-7400
1-800-333-3333
Fax: 212-315-0349
Twin: $130.00
Deadline Sept. 19

Sheraton Hotel
811 Seventh Ave. @ 52nd St.
New York, NY 10019
Tel: 212-841-6450
Fax: 212-841-6730
Single: $225.00
Double: $225.00
Deadline Oct. 24

Rooms are limited; reserve early.

ACT is the . . .



SSOCIATION for ONSTRUCTIVIST EACHING

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. Dues are $20 per year; the membership period runs from January through December.

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.

Benefits of Membership

- THE CONSTRUCTIVIST . . . a scholarly magazine, published three times a year.
- ANNUAL CONFERENCE . . . discounted registration fee and early notice of call for presenters.
- AFFILIATION . . . with an association committed to supporting you.

The Association for Constructivist Teaching

Membership Application

_____ New
_____ Renewal

Name: _____ Title: _____

( ) Business Address: _____ ( ) Home Address: _____

_____ _____

City: _____ State: _____ Zip: _____ City: _____ State: _____ Zip: _____

( ) Business Phone: (_____) _____ ( ) Home Phone: (_____) _____

Please check the address and phone to which we should address our contacts.

Annual* Dues: $20.00
*January–December

Please make your check payable to: The Association for Constructivist Teaching, c/o Dr. Catherine Fosnot, ACT, NAC Room 3/209a, The City College of New York, 138th Street & Convent Avenue, New York, NY 10031