THE CONSTRUCTIVIST

Magazine of the Association for Constructivist Teaching

Volume 14, Number 1 Spring 2002

ASSOCIATION for CONSTRUCTIVIST TEACHING

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A Letter from the President of the Association for Constructivist Teaching

Dear ACT Members,

For the past two years, I have been president of the Association for Constructivist Teaching. My tenure is coming to an end, but the organization is not. The transition will be a smooth one, as Linda Kroll, the current vice-president and program chair, takes over the responsibilities as president.

I'd like to take this opportunity to thank all of you for your support and to recognize the efforts of the board members through the many changes in the past few months. The process of incorporation is moving forward, and we expect all of the legal papers to be completed and filed in St. Louis shortly; the magazine will be moving on-line with the next issue, with financial support from Heinemann; and our database has been brought up to date.

The running of the organization has presented its own special set of challenges. Our most recent challenge came when we were faced with the decision of having to cancel the 2001 annual conference, scheduled for October in the Boston area. With this time coming so quickly after September 11, we were faced with numerous cancellations from presenters and very low registrations for the hotel and the meeting. The hotel was very generous in its willingness to release us from all of the provisions of our contract. Though we were disappointed, we think the decision to cancel was the only option.

All our efforts have now shifted to the planning for our conference in Houston in October 2002. Negotiations with the hotel are being finalized, and we are hopeful that many of the sessions scheduled for the 2001 conference will be included in next year's program. We are also planning to increase the number of sessions offered, so expect to see the Request for Proposals coming your way. (Future conferences will take place in the San Francisco area and in St. Louis.)

This letter would not be complete without an acknowledgement that last year, a very special person resigned from the ACT board of directors. Catherine Twomey Fosnot was the force behind the organization for many years. From the beginning, Cathy devoted time, energy, and even some of her own money to keep the association afloat. She recruited like-minded professionals; she edited and published the newsletter, which under her direction evolved from newsletter to a full-color magazine; she maintained the database; and she contributed to the vision of an association devoted to the ideas of teaching and learning. On behalf of ACT, I would like to thank Cathy for the many years of commitment. Without her efforts, the Association for Constructivist Teaching would not be the thriving organization that it is today.

—Jill Bodner Lester

Tribute to Catherine Fosnot

Dear Readers,

This issue of *The Constructivist* is Catherine Twomey Fosnot's last one as executive editor. As Cathy takes on new professional opportunities and challenges, it is appropriate to mark this passage with an acknowledgement of her many contributions to the magazine. Simply put, we would not have *The Constructivist* were it not for Cathy. Her energy, her tenacity, and her commitment created it and made it what it is today.

I first met Cathy in 1993, when her dream of turning the ACT newsletter into a journal was young but nonetheless already quite refined. She had edited and published the newsletter since its inception, but she saw the need for and potential of a larger publication for the Association—a peer-reviewed, scholarly journal that would provide a forum for longer discussions and allow for more in-depth focus on particular themes. As she and I talked about our mutual endeavors, we began to see possibilities for collaboration, and, ultimately, I offered Cathy and the Association the resources available through the Project Construct National Center. Thus, we began a productive partnership that has lasted for over five years.

With a clear vision of what could be, Cathy transformed *The Constructivist* from an organizational newsletter to a scholarly publication. With a keen sense of what readers need and want, she crafted issues that addressed the thorny and challenging questions inherent in constructivist education.

There have been many "ups" in this endeavor—

collaborations with enthusiastic and talented writers who gave us provocative and insightful articles, the pride of sending out our first issue with its glossy cover and colored pictures, and the sense of accomplishment that comes with realizing a dream. And while there have also been some "downs" (falling behind in our publication schedule, wishing for more article submissions), Cathy was always determined, constantly optimistic, and unfailingly committed to producing the best journal possible.

This issue represents the last hard-copy version of *The Constructivist*. The next issue will come to you in electronic format, with all of the bells and whistles associated with twenty-first century technology. (Watch your postal mail and ACT's Web site for specific information about when the first electronic issue will be available and how to access it.) So it is probably fitting that Cathy's last turn as executive editor is the final hard-copy issue—big changes are sometimes easier to handle than small ones. We will miss her, but we welcome the thoughtful leadership that the new executive editor, Paul Ammon, will provide. At the same time, the Project Construct National Center is turning over management of the journal to Heinemann Publishing Company, but we will continue to offer support in every way we can.

Cathy, it's been a pleasure! On behalf of all those who have contributed to *The Constructivist* (authors, interviewees, Project Construct staff, ACT members) during these past five years, I thank you for your gift to us and to the field—this fine journal, which is impacting education in countless ways.

—Sharon Ford Schattgen
Founding Managing Editor

Letters to the Editor

Please send all Letters to the Editor to Paul Ammon, Graduate School of Education, University of California, Berkeley, CA 94720-1670.

Turn to page 28 for photos from the 2000 ACT Conference in Atlanta...

Contexts for Children's Mathematical Reasoning about Tens and Ones: The Story of Aunt Mary's Candies[1]

Joy W. Whitenack, Nancy Knipping, Sue Novinger, and Gail Underwood

Ms. Clark has asked her second graders to solve the task, 53 – 39 = ____, and to be ready to explain the process they use to get their answers. John raises his hand and, when called on, replies that the answer is 26. He explains that five take away three is two and nine take away three is six. Ms. Clark sees that John has manipulated the individual digits rather than reasoned with groups of tens and ones to solve the task. Although it is not unusual for students to solve tasks in this way when they are initially developing number sense, explanations such as the one offered by John present an instructional challenge for Ms. Clark. How can she help John, and possibly other students, learn to reason sensibly about tens and ones? How can she help him change his conception of knowing and doing mathematics from imitating procedures demonstrated by others to understanding the task involved well enough to develop his own sensible strategies for finding a solution?

In this article, we discuss possible answers to these questions. We suggest that one way to handle such challenges is to have students engage in rich and ongoing contexts (Dolk, Uittenbogaard, & Fosnot, 1996). We define a rich context as one that makes sense to the students and at the same time allows them to solve tasks using their own informal background knowledge. As part of this requirement, the context must enable children to imagine the scenarios that they will encounter as they solve various problems. In addition to being rich, we suggest that the context be ongoing. That is, the context needs to be full enough so that different aspects of it continue to resurface over time. This ongoing nature provides the students with opportunities to extend their mathematical understanding as they revisit issues around the context over and over but in different ways. By engaging in these rich and ongoing contexts, students can use informal methods to reason about situations in the context that eventually allow them to develop more formal ways to reason mathematically (Gravemeijer, 1994).

In our case, the story of Aunt Mary's candies provided such a context. By engaging in activities using this context, students had opportunities to package candy into groups of tens and leave some as loose pieces. That is, they could make collections of tens and ones. The context provided a reason for them to organize their thinking about tens (in packages) and ones (as loose pieces).

We will develop these notions further throughout our discussion. Our goal is to illustrate how teachers can enable students to reason about tens and ones in sensible ways, particularly when solving subtraction problems. To accomplish our

A rich context [is] one that makes sense to the students and at the same time allows them to solve tasks using their own informal background knowledge.

goal, we use examples from one second-grade mathematics classroom in which the classroom teacher, Ms. Jones, used a rich and ongoing context. To make additional points, we include excerpts from a discussion that occurred in her mathematics class as her students solved subtraction problems.

Before sharing our example, we provide some background information about the context that Ms. Jones developed.

Developing the Context

At the beginning of the school year, many of Ms. Jones's students solved subtraction problems by subtracting individual digits—as illustrated in our opening example—and did not notice when their solutions were not sensible. Further, although the students could solve one- and two-digit addition problems, most did not use efficient means for doing so. Ms. Jones was thus faced with the challenge of providing learning opportunities that both brought the students' misunderstandings to the surface and fostered their use of more flexible and efficient methods. To meet this challenge, Ms. Jones developed a series of activities that she planned to implement over several weeks about candy made by her Aunt Mary.[2]

Two issues became important as Ms. Jones grappled with developing and implementing activities using this context. First, the problems she posed needed to make sense to the students so that they could reason mathematically (Gravemeijer, 1994) about Aunt Mary's candies. Not only did they need to determine which operation to perform (addition or subtraction) and why, they also needed to develop sensible methods for working with collections of tens and ones. Second, it was important for Ms. Jones to develop a real-life context—one that came alive for both her and her students during instruction. In other words, the context needed to fit with her own as well as her students' experiences. Because she did, in fact, have an Aunt Mary who made candy, Ms. Jones's stories had a realistic quality that elaborated the context as she introduced various activities. She developed situations about how Aunt Mary made the candy, how she distributed it to various organizations, and how everyone enjoyed eating the delicious candy. By doing so, Ms. Jones provided her students with opportunities to imagine the details of Aunt Mary's candy-making.

On the first day that Ms. Jones introduced problems around Aunt Mary's candy, it was evident that the context was a real-life one for her students. They became very engaged in solving the problem of how Aunt Mary might package her candies so that she could handle large amounts of it.

To solve this problem and find an efficient way to package a bag of candies, Ms. Jones asked her students to work in pairs. She gave each pair a bag of approximately 100 loose multilink cubes, each of which was to represent one piece of candy. She also encouraged them—based on one student's suggestion—to write letters to Aunt Mary and share their ideas with her.

The students' letters to Aunt Mary further illustrated how real-life the context of Aunt Mary's candies was for them. One student, for instance, after suggesting that Aunt Mary should package her candies in groups of tens so she could count the candy easily, suggested that Aunt Mary store the candy she made in her freezer ("freser") (see Figure 1). Other students suggested that Aunt Mary package her candies in fives ("small packages are less

Dear Aunt Mary,
I think you should first cut them into strips.Then cut the strips until yu have ten.Then count them like ten, 20, 30, 40, 50 and so on. Then you put them in the bag and put them in the freser. When your ready to sale them you can tell how many are in the bag.
Love, Kathy

Figure 1. Student's letter to Aunt Mary.

expensive"), nines (the child's drawing had nine pieces in a row), or fifties ("fewer packages are easier to store").

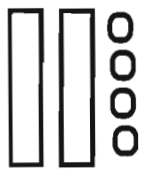
After sharing the students' suggestions with her Aunt Mary, Ms. Jones reported back to her students the following day. She told them that Aunt Mary had found their suggestions very helpful and had decided to package her candy in groups of tens because that was easier for her. Ms. Jones and her students decided that they would package their candy the same way—in groups of tens—whenever possible.

During the first few lessons, students used multilink cubes to make packages (of tens) and pieces (ones) of Aunt Mary's candies. They also began making drawings to represent packages and pieces of candies found on Aunt Mary's candy counter. The stage was well set for the students to begin solving various addition and subtraction problems about Aunt Mary's candies.

How Many Candies Does Aunt Mary Have?

To introduce these new problems, Ms. Jones discussed how her Aunt distributed her candies to various community functions. As Ms. Jones developed this story, she also set up problems the students would solve as they, like Aunt Mary, determined how many candies were left in Aunt Mary's basket, how many more candies she needed to make to fill an order, and so on. Ms. Jones talked about the type and size of basket Aunt Mary used to carry her candies to the different community functions. She also mentioned that Aunt Mary placed inside the basket a cloth that she could wash if it became stained by candy. She spoke as well of how the community organizations did not always tell her Aunt ahead of time about the number of candies they needed. This meant that Aunt Mary needed to figure out several things, such as how many candies she needed to distribute and how many she still had in her basket, when she visited these organizations.

After Ms. Jones fully developed the context about Aunt Mary, she sent the students off in pairs to solve the following problem (rectangles represent packages of 10 candies, and circles represent single candies):

On Monday, Aunt Mary had  candies.

The Humane Society Bazaar ordered 17 pieces. Show how many candies Aunt Mary has left.

As the students began working on this problem, one pair—Abby and Kathy—experienced some difficulty. First, they drew pictures to show the total number of candies sent to the Humane Society Bazaar. Then Kathy, with Abby looking on, rewrote the problem in vertical format and explained to Abby that the answer was 13 because 2 take away 1 was 1 and 7 take away 4 was 3. After she explained her answer to Abby, Kathy checked her answer by counting on from 13, using her fingers. Although she had expected to count on 17 more to reach 24, she only counted on 11. This left Kathy puzzled by her answer. Abby stepped in to revise her response. She pointed to the pictures they had drawn, then covered the pictures with her fingers to explain why the answer was 7. After some discussion, Abby referred again to what Kathy had written (the vertical number sentence) and figured out that the sum of 13 and 17 was 30. Now, both students seemed confused by their answers. Eventually—as we illustrate in the excerpt from the follow-up whole-class discussion—Abby and Kathy agreed on 7 as the answer after they used their picture of the problem to cross out one of the packages and 7 loose pieces to show that 17 pieces of candy were sent to the Bazaar.

When the class reconvened to share their answers and thinking, Ms. Jones asked Abby and Kathy to explain how they solved the problem. The two students came to the chalkboard and explained:

(Abby draws two packages and four pieces on the chalkboard; see Figure 2.)

Ms. Jones: So you're starting out with 24: the 2

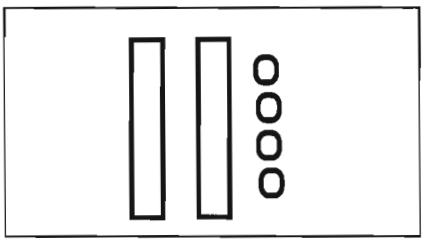


Figure 2. Kathy draws 24 candies.

packages and the 4 pieces.

Abby: Yeah.

Ms. Jones: Okay.

Kathy: And then we knew that we had to take 17 away, so I took this 10 *(crosses through the package on the right)* and brought it to the Bazaar *(writes the word "Bazaar" on the far right and draws an arrow from the crossed-out package to the Bazaar)* (see Figure 3).

Ms. Jones: So you know you had to leave one package at the Bazaar for sure.

Kathy: Mm-hmm.

Ms. Jones: Okay.

Kathy: Then we took this four and took it out *(crosses through the four single pieces and draws an arrow from the crossed-out pieces to the Bazaar)*. Then we took the three out of here *(points to the remaining package, draws a line to divide it, and writes the numeral 3 on the bottom part of the package)* (see Figure 4).

We put that three with this four *(pointing to the loose pieces)* and that made seven *(draws a line to connect the three pieces from the package with the four single pieces)*. That made 7, and because 10 plus 7 makes 17, we took that [7] to the Bazaar *(writes the word "Bazaar" and draws an arrow from the line connecting the 7 pieces to the Bazaar)*. And then right here *(pointing to the package in which she had written 3)*, we still had 7 *(writes the numeral 7 on the top part of the package and crosses out the 3 in the bottom part)* (see Figure 5). So that's how much we have left.

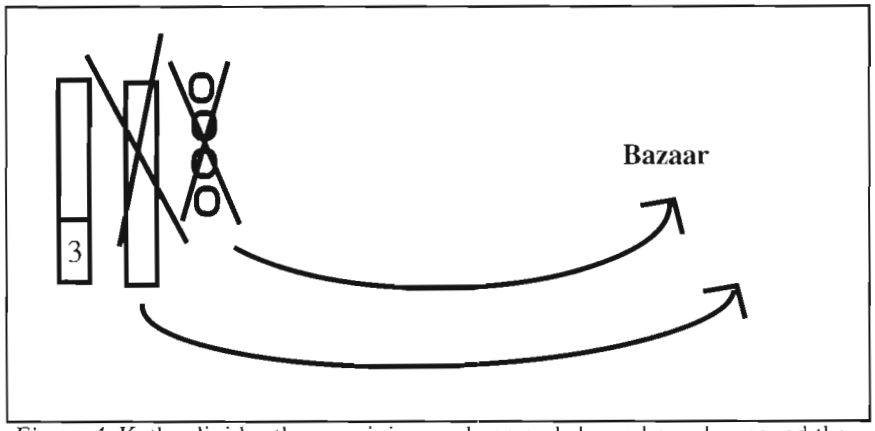


Figure 4. Kathy divides the remaining package and shows how she moved the four loose pieces to the Bazaar.

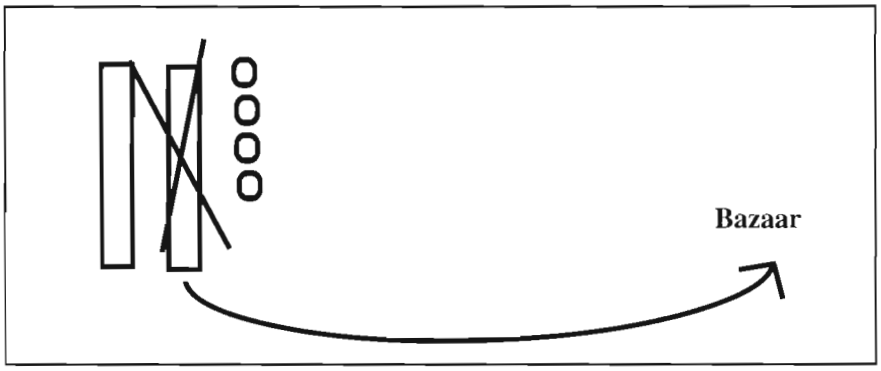


Figure 3. Kathy shows how she moved one package of candies to the Bazaar.

We would like to make two points here about Abby and Kathy's presentation. The first point relates to how this pair continually referred to moving candies to the Bazaar. They clearly imagined the candies actually leaving and going to the Bazaar, as indicated by the arrows they drew to show one package and seven pieces being removed. Further, they did not have any difficulty explaining how they subtracted the candies ordered by the Bazaar. Their explanation was quite systematic, first moving one package,

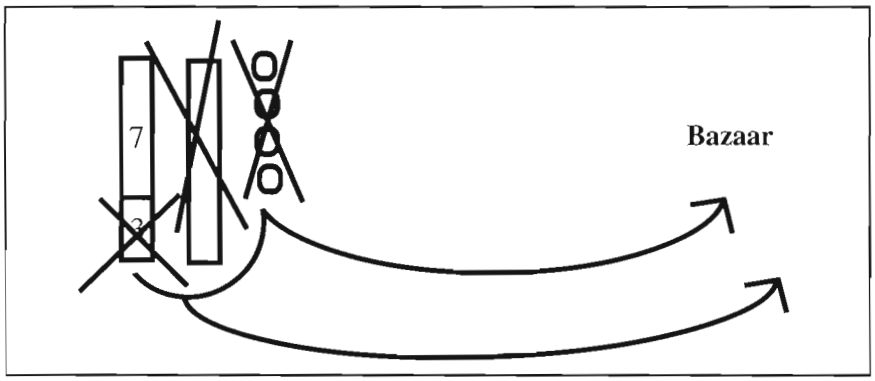


Figure 5. Kathy shows how she combined the three pieces and the four pieces to make the seven more that she needed to send to the Bazaar.

then moving the seven additional pieces by breaking up a package into seven and three pieces and combining the three pieces from this package to the four loose pieces to make seven. Second, as they explained their thinking, they used their own ways of notating as they subtracted the necessary candies. They drew arrows to show the candies going to the Bazaar and drew a line to show the part of the package and the loose pieces that they needed to take away. As their explanation indicated, they not only reasoned sensibly as they subtracted the number of candies, they also used their pictures to explain their thinking.

Following Abby and Kathy's explanation, Ms. Jones asked the rest of the students if everyone had understood their solution method. One student, Alice, explained her understanding:

Alice: They put a line on the second 10 and put an arrow and said "Bazaar."

Ms. Jones: Okay. They took that package and put it in the Bazaar.

Alice: Yes, in there. And then they took four pieces to the Bazaar, and they took the three other pieces with the four pieces.

Ms. Jones (*drawing 10 circles under the remaining package*): But they broke up their package.

Alice: Yeah.

Ms. Jones: This package, right?

Alice: Yes, and they took the three pieces with the four pieces all the way over to the Bazaar, and there were seven left in the package, so that's their answer.

Ms. Jones: Okay.

Using Kathy and Abby's pictures, Alice reconstructed how they had moved 17 candies to the Bazaar, demonstrating that she understood how Kathy and Abby had solved the problem.

Summary of the Lesson

We shared this example to illustrate how students can do sensible things as they solve subtraction problems. Kathy and Abby's story is interesting because they struggled to solve the task when they used more conventional methods. When they realized their calculations did not make sense, they referred back to the pictures of the candies to successfully solve the problem. More importantly, they did so without being taught a set of procedures. Instead, they developed a systematic method for subtracting off the number of candies the Bazaar needed.

Other students also developed sensible methods to solve this problem. Two students (who had worked on the problem as a pair), for instance, explained that they took away 10 (one of the packages) and realized they had 14 left. Because they knew that $14 - 7 = 7$, they knew Aunt Mary had 7 pieces of candy left. Two other students, who had similarly worked as a pair, represented one of the packages as 10 loose pieces of candy (drawn as 10 squares). They first mentally subtracted off 14 by subtracting the remaining package (of 10 pieces) and the 4 loose pieces of candy. Then they subtracted the 3 more they needed by crossing out 3 of the 10 squares (loose pieces of candy) they had drawn to take away a total of 17. Like Abby and Kathy, these students made drawings to show how they had calculated with the packages and pieces of candy.

Some Final Thoughts

Ms. Jones developed these and other activities about Aunt Mary's candies to foster her students' thinking about and with two-digit numbers. Initially, the students used multilink cubes to make packages of candy, and early discussions centered around the different ways in which a given number of candies might be found on Aunt Mary's candy counter when she was interrupted by a phone call while packaging. These activities were followed by problems such as the one we shared earlier for which students began to use pictures to show how many candies Aunt Mary had left after distributing some to the Bazaar.

In addition to these activities, Ms. Jones posed overhead flashing problems later during the unit. She showed pictures of candies for two or three seconds, then asked her students to determine how many candies they saw and explain how they figured out that number (Cobb, Yackel, Wheatley, Wood, NcNeal, Preston, & Merkel, 1992). She posed these problems to provide opportunities for students to mentally combine packages and loose candies to determine the total number of candies. For example, suppose Ms. Jones flashed the image in Figure 6:

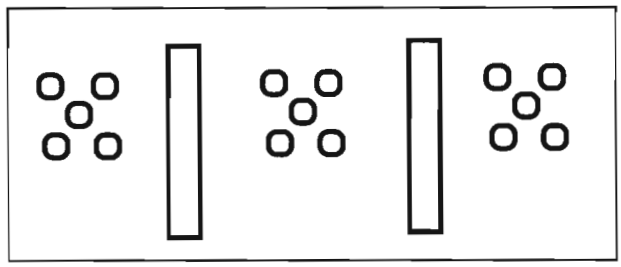


Figure 6. Flashing task with Aunt Mary's candies.

To determine how many candies they saw, students must mentally combine loose candies to make packages, whenever possible. A student might explain, for instance, that she put two groups (the left and middle groups) of 5 candies to make a package of 10, added this package to the two packages to make 30, and then added the remaining 5 to make a total of 35 candies. Unlike our earlier example, where the picture is visible during the discussion, here the student must be able to put the candies together mentally to make packages after the picture is no longer visible. As such, this activity requires the student to mentally make collections of 10, combine these new collections with the other collections of 10, and finally combine these packages with the remaining loose candies. Variations of these types of overhead flashing problems provided Ms. Jones's students opportunities to break packages apart and put pieces together mentally. These problems also provided her with opportunities to notate students' thinking as they explained how they reasoned with the pictures. During early experiences, it was quite common for Ms. Jones to write horizontal number sentences that corresponded with how students thought about the packages and pieces of candy. These experiences made it possible for her students to develop their own ways to use number sentences to record their thinking.

The context of Aunt Mary's candies is only an example of one of many ways to introduce and build on situations that allow students to make sense of their own and others' thinking. In Ms. Jones's class, for instance, students also solved problems using money (pennies, nickels, and dimes). These money activities, along with problems posed about Aunt Mary's candies, provided opportunities for the students to develop increasingly flexible and sensible ways to reason arithmetically.

Informal contexts, such as Aunt Mary's candies, in which students can engage deeply over time, allow them to have numerous opportunities to reason about tens and ones. When the context is an ongoing one, teachers can take time initially to help students become fully engaged in that context. That

way, students are freed from the need to "buy into" a new context when introduced to new problems. Further, by being engaged in such contexts, students can use their real-world knowledge to construct more abstract mathematical ideas.

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Footnotes

[1] This project was supported by the Exxon Education Foundation. The opinions, conclusions, or recommendations expressed in this paper are those of the authors and do not necessarily reflect the views of the funding institution.

[2] Ms. Jones, using the context of Aunt Mary's candies, adapted activities from the Purdue Problem-Centered Mathematics Curriculum Project (Cobb, Yackel, Wheatley, Wood, NcNeal, Preston, & Merkel, 1992) and the Mathematizing, Modeling, and Communicating in Reform Classrooms Project (Cobb, Yackel, & Gravemeijer, 1995). For further discussion about these projects, see Cobb and Bauersfeld (1995) and Cobb, Gravemeijer, McClain, and Whitenack (1997).

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The Usefulness of Misunderstanding

Yeh Hsueh

As a teacher of both preschoolers and graduate students, I have long been fascinated by the development of ideas by children and adults about the phenomena they encounter, as well as by the arguments used to buttress them. By "idea," I mean a thought that connects aspects of observed phenomena, such as the relationship between the first line of a poem and the last or the relevance of a particular learning theory to teaching. By "argument," I mean the reasoning and the sequence of statements offered to justify an idea.

I have been simultaneously fascinated by those influential figures whose works have shaped the different movements of constructivist teaching in the United States. Much can be learned about the development of their ideas and arguments from studying their writings over the course of their careers. While Jean Piaget has been acknowledged as the most prominent figure in this field, there are others equally significant. One such figure is Lev Vygotsky, who is no stranger to those of us who are enthusiastic about constructivist theories.

In this article, I would like to focus on one area of Vygotsky's research—the relationship between children's spontaneous concepts and the more widely held scientific concepts they learn in school. My goal is to show how even though, in the peculiar social context of the Soviet Union, Vygotsky both misunderstood and criticized Piaget's work in this area, he still made insightful pedagogical arguments with which Piaget would have agreed in principle. My aim, thus, is not to refute Vygotsky's interpretations of Piaget. Rather, I want to use this case study to show how useful such misunderstandings can be in the development of one's own ideas.

Must the Child's Thought Be Considered an Enemy of the Teacher?

In Chapter Six of *Thought and Language*, one of his most influential books, Vygotsky (1934/1986) introduced his theory of the Zone of Proximal Development, which stated that a child can reach a higher level of performance with the assistance of an adult than he can by himself. The Zone, which has many implications for instruction, referred to the gap between this supported and unsupported performance. Although Vygotsky credited Piaget with the conceptual distinction between children's own ideas and those transmitted to them by adults—also known as a distinction between spontaneous and non-spontaneous ideas—he declared that there were errors in Piaget's account of this distinction.

According to Vygotsky (1934/1986), Piaget made his first error by believing that the spontaneous concept alone can best inform educators of the nature of the child's thought. This belief left the non-spontaneous concept no room in school instruction.

From this overemphasis on the spontaneous construction, Piaget made a second error: he failed to understand that the two types of concepts, spontaneous and non-spontaneous, interact with each other within one system of thought. This led—Vygotsky reasoned—to Piaget's third error: the belief that school instruction played no role in children's own thinking or scientific-concept formation (pp. 154–155).

These criticisms appear persuasive as long as one does not actually examine the texts Vygotsky cited, namely, *The Language and Thought of the Child* (1923/1955) and *Judgment and Reasoning in the Child* (1924/1966). These books reveal that ten years before Vygotsky criticized him for too radically dichotomizing these modes of thinking, Piaget had already made clear that he was not advocating a strict theoretical separation between the two. He had argued, for example, that if teaching intends to help children become conscious of something they had never known before, something they will work on further, then teaching must bring children's thinking into interaction with the influence of adults:

> The mind becomes conscious of itself, and consequently exists psychologically speaking only when it is in contact with objects or with other minds. We have here two different planes [biological and sociological], theoretically independent of one another . . . but in practice, these two planes will always be associated, so long as the child has parents who represent Society to him, and so long as he experiences sensations which constitute a biological environment. Describe the evolution of thought from the purely biological point of view, or . . . from the purely sociological point of view, and you risk leaving half the real process in the shade. (Piaget,1924/1966, p. 201)

Research shows that in the 1920s, Vygotsky and his colleagues studied and replicated Piaget's work extensively (Van der Veer & Valsiner, 1991). Given that, one wonders how Vygotsky's summary could have overridden the ideas that he and Piaget clearly shared? Indeed, Vygotsky seems to have been so intent on portraying Piaget's ideas as different from his own that he even attributed ideas to Piaget that were not the latter's. For example, Vygotsky (1934/1986) wrote of Piaget, "Theoretically, socialization of thought is seen by Piaget as a mechanical abolition of the characteristics of the child's thought, their gradual withering away" (p. 155). This oversimplification allowed Vygotsky to couch Piaget's work on development and learning in terms of a military metaphor, as intellectual warfare between children's own spontaneous thought and the non-spontaneous concepts teachers put into play in the classroom. In support of his claim, Vygotsky (1934/1986) referred to a speech Piaget delivered in 1933 at the International Conference for the Teaching of History:

> It seems that when he [Piaget] says that nothing is more important for effective teaching than a thorough knowledge of the spontaneous thought of children, he means that the child's thought must be known as any [sic] enemy, must be known in order to be fought successfully. (p. 157)

Was this truly Piaget's position? Did Piaget really conceive of teaching non-spontaneous concepts, such as history, as warfare waged by teachers against children's spontaneous thoughts? I will let Piaget (1933) speak for himself:

> But if . . . the education of the child's historical sense presupposes the education of the objective and critical mind, the education of intellectual reciprocity and of the sense of values and proportion, nothing would seem to be more important for determining the technique to be used in teaching history than the psychological study of the child's intellectual attitudes, however naive and negligible they may appear at first sight. (p. 18)

Perhaps Piaget did attend too closely to children's own "intellectual attitudes"—their spontaneous thoughts. Perhaps he also did not pay sufficient attention to other complex issues in education such as children's family, economic, and linguistic backgrounds. But clearly for him, the relationship

between children and their teachers was reciprocal, which, of course, left room for and respected children's "intellectual attitudes." In other words, according to Piaget, effective teaching does appreciate spontaneous thought. It does so because it recognizes that such thoughts can help teachers cultivate critical minds, support intellectual reciprocity, and shape/inform children's sense of values and proportion. Where is the warfare in this? A careful search through Piaget's writings fails to locate any usage of the military metaphor.

According to Piaget, effective teaching does appreciate spontaneous thought. It does so because it recognizes that such thoughts can help teachers cultivate critical minds, support intellectual reciprocity, and shape/inform children's sense of values and proportion.

Piaget himself marveled that Vygotsky could have found a bellicose cast in his writings. "There is in fact," Piaget (1995) wrote, "a complete misunderstanding on the part of Vygotsky when he thinks that from my point of view the child's spontaneous thought must be known at close quarters by educators so as to get to know better 'the enemy to be beaten' " (p. 331).

Perhaps Vygotsky, a voracious reader (Cole & Cole, 1979), confused Piaget with William James in recollection. In his *Talks to Teachers* (1892/1958), one of the earliest books to introduce teachers to what was then the new field of psychology, James had written,

> The science of psychology, and whatever science of general pedagogics may be based on it, are in fact much like the science of war. Nothing is simpler or more definite than the principles of either. In war, all you have to do is to work your enemy into a position from which the natural obstacles prevent him from escaping if he tries to; then to fall on him in numbers superior to his own, at a moment when you have led him to think you far away; and so, with a minimum of exposure of your own troops, to hack his force to pieces, and take the remainder prisoners. (p. 25)

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The vividness of this metaphor might well have made a lasting impression on its readers, especially if they were pedagogically inclined. Although we don't know for certain whether Vygotsky read *Talks to Teachers*, we do know that he studied James, and *The Principles of Psychology* (James, 1890/1983) in particular, on which *Talks to Teachers* was based (Van der Veer & Valsiner, 1991, 1994; Vygotsky, 1978, 1934/1986).

The Usefulness of Misunderstanding

Still, we can learn much from Vygotsky's misunderstanding of Piaget. Whatever their basis, Vygotsky's arguments were well organized and developed a philosophically plausible theme in which he (1934/1986) made four important points:

[A] Spontaneous and nonspontaneous concepts "may be expected to follow differing develop-

mental paths from inception to final form" (p. 158).

[B] This is because children's reasoning of either type is dynamic; it does not stop at its inception, but contains within it ever-developing possibilities of new meanings. This is the "developmental principle" (p. 159). Theoretically, the two types each have their own conditions for development, but they are "the two forms of one and the same process, which imprints its characteristic signature on both" (p. 160).

[C] Since most of the (then-) current psychological studies are on spontaneous concepts, there is an urgent need for studying the formation of non-spontaneous concepts, "which are real concepts" (p. 161).

[D] The emphasis on non-spontaneous concepts has important implications for instruction, since scientific "concepts are not absorbed ready-made, and instruction and learning play a leading role in their acquisition" (p. 161).

The reasoning from [A] to [B] that the two concepts are opposite but interrelated bears the imprint of a reading of Hegel that is deeply embedded in the Marxist-Leninist view of knowledge and science (Vygotsky, 1934/1986, p. 52, p. 173). According to this view, children cannot absorb the scientific concepts in an unaltered, undigested, and unyielding manner since these concepts differed completely from spontaneous ones. For this reason, Vygotsky (1934/1986) argued, "the acquisition of scientific concepts is carried out with the mediation provided by already acquired concepts" (p. 161). This reasoning led to his conclusion in [C] and [D] that studying the formation of non-spontaneous concepts — "the most promising approach" (p. 161)—held the key to the learning and development of children. Similar reasoning appeared in Vygotsky's criticism of Piaget's bourgeois (because of its presumed individualism) research project that prioritizes an understanding of children's spontaneous activities as the point of departure for instruction. Vygotsky (1934/1986) maintained that Piaget failed to grasp the fact that the conscious use of scientific concepts would lead children out of their unsystematic spontaneous thinking:

> Piaget's inability to resolve the problem of consciousness stems from his adherence to spontaneous concepts, viewed by him as the only legitimate products of the child's thought. Rejecting the notion of a conceptual system, Piaget made the resolution of the problem of consciousness impossible. (p. 174)

This criticism from Vygotsky did not arise without a context. Elsewhere, too, he reiterated a Leninist vanguardist philosophical belief, that advanced and systematic knowledge such as the Marxist theory of societal development must be taught to members of the working class, for they cannot spontaneously acquire it (Vygotsky, 1930/1994). According to him, attention should be given not so much to how children learn as to how systematic knowledge should be taught for the sake of children's mental development. "Teaching," Vygotsky argued, "is only effective when it *points to* (italics added) the road for development" (Van der Veer & Valsiner, 1991, p. 331,) just as Marxist teaching is effective only because it points to the road of the future society—a fundamental belief in the Soviet Union at that time.

In his 1962 commentary on Vygotsky's *Thought and Language*, Piaget (1962/1995) expressed agreement with Vygotsky on the reciprocity of learning and development. The "developmental principle" and the point of philosophical unity in [B] were theoretical orientations that he shared with Vygotsky across ideological lines. He did differ, however, from Vygotsky's reasoning about effective teaching. In 1935, in his capacity as the director of the Bureau of

International Education, Piaget (1935/1970) wrote of the new education in the 20th century,

> The child no longer tends to approach the state of adulthood by receiving reason and the rules of right action ready-made, but by achieving them with his own effort and personal experience; in return, society expects more of its new generations than mere imitation: it expects enrichment. (p. 138)

In this statement, Piaget deemed the effort and personal experience of the child as essential to school learning and, ultimately, to the betterment of society. To this end, the effectiveness of school instruction, according to Piaget, was dependent more on the spontaneous thoughts of children than on the instructional effort to map out the path for children's development. This view reflected Piaget's conviction that conventional school instruction was based only marginally on the understanding of children. He felt that without carefully exploring children's spontaneous reasoning, research on how children acquire established, systematic knowledge may only marginally enhance traditional teaching. For Piaget, the need to take a close look at children's thinking in school was urgent and most promising; a deep understanding of children's logic was a prerequisite for effective teaching of systematic knowledge and would open up a new world to formal schooling. Thus, while Vygotsky believed that teaching should chart the path of children's development—a view not much different from the one held by advocates of traditional instruction—Piaget argued that a greater understanding of children's thoughts was necessary to improve teaching. The failure of contemporary readings of Vygotsky to note this difference often arises from blindly removing Vygotsky's criticism of Piaget from the Soviet social and intellectual context, which demanded socialization of children to a world view promulgated by the Soviet Communist Party and promoted as scientific thinking.

Recognizing this distinction is important, for it is only in this social context that one can see how by criticizing Piaget, Vygotsky actually clarified his own ideas about a crucial aspect of teaching needed in the Soviet Union. Thus, he argued, that although children's learning of systematic knowledge required a continuous interaction between the spontaneous and the non-spontaneous or scientific concepts, the ultimate goal was to establish the most advanced and correct systematic knowledge in children's minds through the mediation of their own spontaneous thoughts. This line of thinking, which was in unison with the Soviet vision about the future of societal development, is reflected also in Vygotsky's other writings on societal development. Everywhere, he expresses the belief that in education, there is a fundamental need to focus on the progress of human society by emphasizing the instruction of systematic concepts such as Marxist ideas and the natural sciences. He wrote,

> It is education which should play the central role in the transformation of man —this road of conscious social formation of new generations, the basic form to alter the historical human type. *New generations and new forms of their education represent the main route which history will follow whilst creating the new type of man.* (Vygotsky, 1930/1994, p. 181)

"The new forms of education" and "the new type of man" were not generic terms for any educational system or any "man." They were specific to the Soviet ideal—the main route that history would follow to lead human society out of capitalism and into communism. To materialize this ideal, education required conscious social formation of children by emphasizing scientific knowledge—of Marxism and the natural sciences. This was the social context of Vygotsky's reflections on instruction.

By forming new psychological ideas in the context of what

he saw as the material-based Soviet ideal, Vygotsky demonstrated in principle the very argument with which Piaget would agree—that children (and even adults) use external concepts to meet their own needs and, as a result, develop their own thoughts. This perspective brings about a question that has not been asked before in the literature on Vygotsky's work: Was it productive for him to be impressionistic in his reading of Piaget and, as a consequence, invent a straw Piaget? The answer to this question allows us to see how Vygotsky's misunderstanding met two internal needs of his own established thinking.

By forming new psychological ideas in the context of what he saw as the material-based Soviet ideal, Vygotsky demonstrated in principle the very argument with which Piaget would agree—that children (and even adults) use external concepts to meet their own needs and, as a result, develop their own thoughts.

The first need that the misunderstanding fulfilled was to conceptualize a homology between children and societal development in order to view both school instruction and societal development in the same light. Vygotsky's misunderstanding of Piaget manifested a belief that was consistent with the idea he was developing—that instruction needed to be emphasized for society to shape a new type of man. As stated earlier, Vygotsky believed that research priority should be given to the development or the instruction of scientific concepts.

The second need that the misunderstanding fulfilled was to define his work by making clear the distinction between his Marxist-Leninist ideas and those of bourgeois thinkers such as Piaget. This required a public move against Western psychologists' ideology as presented in their scientific work in order to clarify his own psychological ideas for application in the Soviet pedagogy. His misunderstanding of Piaget allowed him to systemize his own experience and thinking about child psychology while—as a recent study by Van der Veer (1996) suggests—remaining in line with Soviet rejection of non-Communist psychology. Ironically, Vygotsky's ideas about teaching, particularly the Zone of Proximal Development, were adopted by many contemporary Western educators, despite the Cold War. But this could not have happened without his critical reading of Piaget and his consequent rise to fame as a prominent Soviet psychologist.

A profound thinker, Vygotsky seemed to pursue ideas that were based on his own intellectual and social life and did not fit the ideas espoused at the time. Exploring a vast terrain of then-current philosophy and psychology, he gathered various thoughts and ideas from different sources, scrutinized them in their assimilated forms, and integrated the new forms into ideas that he then tried to develop. It was during that process that he found Piaget, a rising child psychologist in Western Europe, and made him "a whipping boy" for developing his own ideas on the instruction of scientific knowledge in Soviet schools.

Thinking about Teaching

We will never know for sure exactly how Vygotsky created some of his interpretations of Piaget, how he came to ascribe the warfare metaphor to Piaget, and why for a long time we took it for granted that Vygotsky criticized Piaget with accurate references. What we do know with some certainty are Vygotsky's ideas and his reasoning process as represented in his book and the fact that his

ideas converged crucially with those of Piaget, his unacknowledged friend in Switzerland. We also know from a close examination of the two thinkers' relevant writings that Vygotsky was an inventive thinker who was more engaged in his own thinking about child psychology and its practical application to school instruction in the Soviet Union than in ensuring the accuracy of his interpretations of Piaget.

My interest in examining this historical debate arose from my own experiences as a teacher. When a student tries hard to work out an idea, using various experiences and materials to develop it, there is always a solid possibility that s/he will mix up or reconstruct ideas and facts. What fascinates me is this: Imagine Vygotsky is our student, and he has mixed up facts and forgotten to check his sources. Yet he persistently struggles to present an idea in terms of his own experiences. Wouldn't we as teachers notice and encourage such an effort? As I have described in this article, Vygotsky's misunderstanding helped him develop his own insights, which were productive even though others had arrived at similar ideas before him. What is the difference between a famous thinker like him and a student, young or old, before us?

Since *Thought and Language* was first published in English in 1962, even the flaws in Vygotsky's citations and readings have not diminished serious consideration of his pedagogical ideas. It seems to be the end product of his thinking that has come to matter. However, as teachers supportive of constructivist learning, we need to pay attention to the developing process of thinkers' ideas. Our focus should be on understanding how students develop their own ideas, whether through interactions with materials, with ideas, with one another, or with society. If we were to encounter a student who reasoned as did Vygotsky in his misunderstanding of Piaget, our task would be complex, for we would have to consider three sets of implications: academic, moral, and those relevant to the process of the student's evolving idea. But it is just this complexity that permits us as teachers to enter the realm of students' active learning. Just as we might find Vygotsky's thinking more interesting once we notice him struggling to form his own idea, so, too, we would find our students' ideas valuable if we tried to capture their thinking processes. This would further not only their learning but also our own.

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Child Psychologist

Jean Piaget

He found the secrets of human learning and knowledge hidden behind the cute and seemingly illogical notions of children

Seymour Papert

(Editor's Note: The following article was originally published in TIME magazine's 1999 series titled "Century's Greatest Minds." It provides a concise, reader-friendly sketch of Piaget's biography and his invaluable contributions to the fields of epistemology, psychology, and child development.)

Jean Piaget, the pioneering Swiss philosopher and psychologist, spent much of his professional life listening to children, watching children and poring over reports of researchers around the world who were doing the same. He found, to put it most succinctly, that children don't think like grownups. After thousands of interactions with young people often barely old enough to talk, Piaget began to suspect that behind their cute and seemingly illogical utterances were thought processes that had their own kind of order and their own special logic. Einstein called it a discovery "so simple that only a genius could have thought of it."

Piaget's insight opened a new window into the inner workings of the mind. By the end of a wide-ranging and remarkably prolific research career that spanned nearly 75 years—from his first scientific publication at age 10 to work still in progress when he died at 84—Piaget had developed several new fields of science: developmental psychology, cognitive theory and what came to be called genetic epistemology. Although not an educational reformer, he championed a way of thinking about children that provided the foundation for today's education-reform movements. It was a shift comparable to the displacement of stories of "noble savages" and "cannibals" by modern anthropology. One might say that Piaget was the first to take children's thinking seriously.

Others who shared this respect for children—John Dewey in the U.S., Maria Montessori in Italy and Paulo Freire in Brazil—fought harder for immediate change in the schools, but Piaget's influence on education is deeper and more pervasive. He has been revered by generations of teachers inspired by the belief that children are not empty vessels to be filled with knowledge (as traditional pedagogical theory had it) but active builders of knowledge—little scientists who are constantly creating and testing their own theories of the world. And though he may not be as famous as Sigmund Freud or even B.F. Skinner, his contribution to psychology may be longer lasting. As computers and the Internet give children greater autonomy to explore ever larger digital worlds, the ideas he pioneered become ever more relevant.

Piaget grew up near Lake Neuchâtel in a quiet region of French Switzerland known for its wines and watches. His father was a professor of medieval studies and his mother a strict Calvinist. He was a child prodigy who soon became interested in the scientific study of nature. When, at age 10, his observations led to questions that could be answered only by access to the university library, Piaget wrote and published a short note on the sighting of an albino sparrow in the hope that this would influence the librarian to stop treating him like a child. It worked. Piaget was launched on a path that would lead to his doctorate in zoology and a lifelong conviction that the way to understand anything is to understand how it evolves.

After World War I, Piaget became interested in psychoanalysis. He moved to Zurich, where he attended Carl Jung's lectures, and then to Paris to study logic and abnormal psychology. Working with Theodore

Simon in Alfred Binet's child-psychology lab, he noticed that Parisian children of the same age made similar errors on true-false intelligence tests. Fascinated by their reasoning processes, he began to suspect that the key to human knowledge might be discovered by observing how the child's mind develops.

Back in Switzerland, the young scientist began watching children play, scrupulously recording their words and actions as their minds raced to find reasons for why things are the way they are. In one of his most famous experiments, Piaget asked children, "What makes the wind?" A typical Piaget dialogue:

Piaget: What makes the wind?

Julia: The trees.

P: How do you know?

J: I saw them waving their arms.

P: How does that make the wind?

J (waving her hand in front of his face): Like this. Only they are bigger. And there are lots of trees.

P: What makes the wind on the ocean?

J: It blows there from the land. No. It's the waves...

Piaget recognized that five-year-old Julia's beliefs, while not correct by any adult criterion, are not "incorrect" either. They are entirely sensible and coherent within the framework of the child's way of knowing. Classifying them as "true" or "false" misses the point and shows a lack of respect for the child. What Piaget was after was a theory that could find in the wind dialogue coherence, ingenuity and the practice of a kind of explanatory principle (in this case by referring to body actions) that stands young children in very good stead when they don't know enough or have enough skill to handle the kind of explanation that grownups prefer.

Piaget was not an educator and never enunciated rules about how to intervene in such situations. But his work strongly suggests that the automatic reaction of putting the child right may well be abusive. Practicing the art of making theories may be more valuable for children than achieving meteorological orthodoxy; and if their theories are always greeted by "Nice try, but this is how it really is..." they might give up after a while on making theories. As Piaget put it, "Children have real understanding only of that which they invent themselves, and each time that we try to teach them something too quickly, we keep them from reinventing it themselves."

Disciples of Piaget have a tolerance for—indeed a fascination with—children's primitive laws of physics: that things disappear when they are out of sight; that the moon and the sun follow you around; that big things float and small things sink. Einstein was especially intrigued by Piaget's finding that seven-year-olds insist that going faster can take more time—perhaps because Einstein's own theories of relativity ran so contrary to common sense.

Although every teacher in training memorizes Piaget's four stages of childhood development (sensorimotor, preoperational, concrete operational, formal operational), the better part of Piaget's work is less well known, perhaps because schools of education regard it as "too deep" for teachers. Piaget never thought of himself as a child psychologist. His real interest was epistemology—the theory of knowledge—which, like physics, was considered a branch of philosophy until Piaget came along and made it a science.

"Children have real understanding only of that which they invent themselves, and each time that we try to teach them something too quickly, we keep them from reinventing it themselves."

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Silence, Culture, and Constructivism

Kathryn Castle and Anna McKibben

Telling Stories

One thing about it . . . you get those old folks talking . . . you couldn't ask questions. They just tell you what they want; because if you did ask questions, they would get mad and shut up. You would just have to sit there and be quiet. You couldn't ask questions . . . even my mother. I've asked her questions, she just quit talking. . . . The only answer I got when I asked questions is, they would call me an old white woman.
(Anonymous Native American author, *OGAXPA*, 1976, p. 41.)

The following is a real story about silence, culture, and constructivism. In it, Dr. Castle, a white professor of primarily European descent, and Anna McKibben, her Native American graduate student, attempt to make sense of events and behaviors during a graduate seminar on constructivism. Both teacher and student try in their own accustomed ways to understand the other and to bridge the gap of culture and understanding that separates them. As the semester progresses—as well as the story—both assume dual roles, as teacher and learner, and grow to understand and appreciate the power and meaning of the silence operating in their relationship.

The story is presented through journal entries made by both student and professor during the course of the semester. It is organized by the four phases that both went through during their interactions with one another, which also coincide with the phases that students go through when attempting to understand constructivism—initial disbelief, frustration and inadequacy, search for new answers and formulation of new questions, and reflection (Castle, 1997).

Phase I: Initial Disbelief

Anna: My first graduate class was a seminar on constructivism taught by Dr. Castle. She didn't seem old enough to be a graduate teacher. I thought that since graduate school teachers are supposed to have vast amounts of knowledge, they have to be ancient to be that intelligent.

On the first day of class, everyone was playing children's games when I walked in. I was quite amazed and thought to myself, "What have I gotten myself into? What kind of class is this?" I went to a seat away from everyone else and started looking at some puzzles that were on the table in front of me. Everyone but me seemed to know everyone else. The only person I knew was Claire, another Native American graduate student, but we had never talked to each other.

I sat there alone, working with the puzzles and thinking, "I'm in graduate school and playing with toys!" I always thought that when you were in graduate school, all the fun stopped! Yet now, not only was everyone having fun playing games together, they were all having fun except me. I really wanted to leave. Someone spoke with me for a little while but then politely told me it was nice to meet me and walked away.

Shortly after, Dr. Castle did something that no professor had ever done to me. She came over, introduced herself, and asked me my name. Since I am a first generation graduate student, I thought that perhaps learning students' names was something instructors did in graduate school.

After she talked with me, Dr. Castle began talking to the class. She wanted us to introduce ourselves and say a few words about our goals. She also asked us our ideas and opinions about constructivism—a word I had never heard before.

My heart began to pound, and I started to shake. There is something about talking in front of a group of people that paralyzes me with fear. When my turn came, I went blank. I could feel everyone's eyes on me. I think I said something about wanting to help Native American students, but all I really remember is talking until I thought I had said enough and being relieved that it was someone else's turn.

There were two older women in the class who seemed to talk as much as Dr. Castle. I felt that they were interrupting the discussion. Yet, surprisingly, Dr. Castle was encouraging everyone to talk. Most of my undergraduate professors had lectured, stopping only to answer a few questions.

That day, I left the class deep in thought about what I had just experienced. I was still quite amazed by what I had seen. The games and the student involvement were very new to me, as was the professor's interest in getting to know her students individually. Although I liked listening to what everyone had to say in class, I hoped that no one would ask me what I thought because I did not know.

The following week, however, I decided that I would go in to class and talk! Although I had never done it in any of my undergraduate classes, I decided that it must be the way to do things in graduate school.

When I walked into the classroom that week, everybody was actively involved with something or another. No one seemed to notice me. Immediately, I felt left out, and all my good intentions went out the window. Once again, while others spoke a lot during the class, I did not say anything. I left the class feeling very remedial.

Dr. Castle: My purpose in teaching the seminar on constructivism is to deepen students' understanding of the application of constructivist theory to classroom practices. Fosnot (1996) writes that teacher educators should challenge traditional practices by engaging students in activity, reflection, and discourse. Accordingly, I try to create a relaxed classroom atmosphere in which students are comfortable sharing their ideas and engaging actively in discussions and activities.

Fosnot (1989) also recommends designing the first class purposefully to create disequilibrium, to throw students into some cognitive confusion so that they will have a need to make sense of what is going on. As students enter my class on the first day, they encounter a variety of materials with which they can interact in various ways. After an initial activity time, we discuss how they reacted to what they saw when they entered the class, their confusion, and the sense they made as they began to interact with the materials and with one another.

This semester, everyone seemed involved on the first day except Anna and Claire, two Native American students. I was aware they knew each other and wondered why they were not more active in the class. I also wondered why Anna, in particular, seemed so distant with everyone. Perhaps it was because she is shy, perhaps because she did not know the others. Perhaps even, because this was her first experience with graduate classes. I thought the class was non-threatening and friendly. I even talked individually with several of the students I didn't know to become acquainted. How could a student feel threatened in this friendly environment where others were having so much fun?

I hope Anna and Claire warm up soon to the class.

Phase II: Frustration and Inadequacy

Anna: Everyone seems to be comfortable in the class. More people are participating in discussions, but I feel like I have nothing to contribute. One grueling day, Dr. Castle began to ask us questions about the reading assignment. To those

who gave the right answer, she gave a piece of candy! I had not been able to read the articles due to the death of a close family member and, thus, did not know the answers to any of the questions. I prayed that she would skip me, but she did not, so I had to say that I did not know the answers. I felt like going to the corner with a dunce cap on. Although the others tried to share their "prize" with me, I could not help but be very aware that everyone except me had received candy.

I am very angry at my inability to overcome my shyness and say something in class. Yet every time I start to say something, I feel inept. I feel like I know nothing.

Dr. Castle: I feel very frustrated about not getting the level of active involvement in discussions that I thought was appropriate for a small class. I also wonder why Anna and Claire are so quiet. Are they bored, or are they rejecting the ideas, which might be too discrepant from their beliefs about learning? Or is it me? Even though I intended to reduce professorial authority and engage actively in discussion with them on an equal footing, perhaps I am coming across as too authoritarian and didactic?

During one class, I used candy rewards for student responses to questions to make a point about autonomy. It is a move that usually shakes up students to the idea that rewards can be as coercive as punishments. I noticed that some of them were able to figure out in less than two seconds what I was trying to do. I also noticed that those who got the candy were eager to share it with those who didn't. I took this as evidence of a classroom community in action. During the class, we discussed Kohn's (1993) idea of manipulation through rewards and the distinction between autonomy or self-regulation and heteronomy or regulation by others (Kamii, 1985).

Many seemed to understand the concepts, but I couldn't tell what was going on with Anna and Claire. When I called on Anna to answer a question over the assigned reading, she didn't have an answer. Was she angry that I had called on her specifically? I had called on everyone else, too. Is she rejecting the ideas and merely enduring this class? At this point, I am really struggling with my inability to engage Anna and Claire. Even my best attempts seem to be futile. How can I be failing so miserably? I am an experienced professor who has taught this seminar numerous times before. I am embarrassed by my inability to interest these students, and I am feeling quite inadequate.

Phase III: Search for New Answers and Formulation of New Questions

Anna: I enjoy listening to Karl [another student] during class discussions. He always says something that interests me or makes me question my own thinking. An example is his light bulb theory. He said that once people discover a new way of thinking, it is difficult for them to think the way they did previously. Karl also helped me see how a constructivist view of learning could help me understand both teaching and learning (as a teacher). Just as Burk and Dunn (1996) explained in the article we read for class, adults need learning experiences on an ongoing basis, especially if they expect to reinvent their theories (and practices) of teaching.

I remembered Karl's light bulb theory when I was reading about autonomy, a concept that marked a milestone in my journey toward constructivism. Earlier, I had absentmindedly read the articles we were supposed to read for class. I had read them only because they were assigned. I did not care about them. Then suddenly, like a light bulb coming on, I became interested. It was the concept of autonomy that sparked the flame. I began to understand how autonomy is not about doing as you please, but about being self-governing.

Now, constructivism and articles by Piaget began to make sense. Motivated, I went back and reviewed previously assigned articles and the video *Piaget on Piaget* (University Media Design Studio, 1977). The children's ways of lining up sticks, measuring string length, and solving problems made so much more sense to me! I started sharing with my sister the wonderful things I was learning about constructivism, and I approached my niece in new ways. I now believe that my niece's early development will influence her later years of learning.

The day of our midterm presentations marked another milestone in my understanding of constructivism. Specifically, it was Claire's paper that opened the door to a deeper understanding. In it, she had applied constructivism to Native American dances and discussed how children construct their knowledge of traditional dances. Just when I thought I had understood constructivism well, I learned that it applied to other areas besides children's learning in classrooms. What a revelation!

Dr. Castle: As classes went by, I knew I had not made much progress in getting Anna and Claire to talk in class. I couldn't remember a time of such struggle and disappointment in the direction a class had taken. I exhausted what I knew to do in order to engage these students in discussing constructivism, and I was beginning to think that I might not know as much as I thought about creating classroom community.

Then, at some point, I started noticing that Anna and Claire were beginning to open up to others in class. They even appeared to be forming friendships. Anna seemed to light up when Karl, in particular, came to class. I learned later that Anna and Claire had not only started building relationships with other members of the class, they were also discussing their ideas about constructivism with others outside the class.

On the day of the midterm presentations, I got a big surprise! Claire's paper, which was about how Native American children construct their knowledge of tribal dances, turned out to be a thoughtful and creative application of constructivism to her own experiences in working with Native American children. I was amazed and impressed by the depth of her understanding of the theory, especially since she was always so quiet in class. How could a student have learned so much without engaging in class discussions and debates? I had interpreted Claire's behavior during classes to imply boredom and disinterest. But this was not the paper of a bored, disinterested student! I was forced to rethink my interpretation of her behavior. I also began to wonder if, in fact, it might be possible to learn without talking in class.

Phase IV: Reflection

Anna: After listening to Claire's paper, I found myself reflecting on a game that I had learned as a child: Indian dice. I learned to play by watching . . . and creating my own understanding about how to play. Now, when I think back to the way I learned the game, I realize that my process of learning was clearly a constructivist one.

Although this game is played by many tribes, no one knows for sure where it originated. My family played the game during Thanksgiving. Once, I asked my dad why he never asked his mother if she knew. His answer was that he was not allowed to ask questions. In our tribe, children are raised to accept unquestioningly things that elders tell them. They learn that if you question elders, they think you do not believe them, and they stop telling you stories. Quickly, you learn that the quieter you are, the more stories you are told, and the more you learn.

I could tell from what Claire had said in class that her tribe and mine have similar beliefs. She had said that when she was young, she was expected to not say anything. Her opinion was not considered important. Claire's comments helped me understand that just because I did not speak out in class, it did not mean I was not learning, not deepening my understanding of

constructivism. Silence in class was my way of learning. I listened to what people said, took notes, and reflected on what I heard. It was my personal form of class participation, and it built my understanding.

Earlier in the semester, I had worried that I might not pass the course because I rarely spoke in class. But today, I know I have learned a lot about constructivism because my thinking has changed. I am becoming a more autonomous person.

Dr. Castle: During one of our last sessions, Claire and Anna shared more about their Native American culture with the class and explained how they were raised to not question elders. I viewed their willingness to share their ideas with the class as an indication that they had grown comfortable with the group. Claire and Anna's final papers also came as a revelation. They had learned so much about constructivism and had applied it so well to their own experiences!

Tactful silence may mean that one realizes there are moments when it is important to hold back and reflect carefully on what is being said. At such moments, silence can be a powerful mediator of meaning.

It forced me to rethink my ideas about student participation in class. I realized not only that silence in class may have more to do with culture than disinterest but also that silence does not always equal a lack of learning. Neither does it always mean that one refuses to speak or feels a lack of voice. It may reflect instead the silence of the listening ear or of wholehearted attentiveness to what occupies one's thoughts and feelings (van Manen, 1991). Tactful silence may mean that one realizes there are moments when it is important to hold back and reflect carefully on what is being said. At such moments, silence can be a powerful mediator of meaning. Silence in a teacher-student relationship carries multiple meanings and may be such a part of one's culture as to go unrecognized and unnoticed (van Manen, 1991). While Anna and Claire have learned about applying constructivism to teaching children during the course of this class, I have learned a great lesson about cultural diversity, student participation, and the power and different meanings of silence.

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("Piaget," continued from p. 20)

Piaget explored a kind of epistemological relativism in which multiple ways of knowing are acknowledged and examined nonjudgmentally, yet with a philosopher's analytic rigor. Since Piaget, the territory has been widely colonized by those who write about women's ways of knowing, Afrocentric ways of knowing, even the computer's ways of knowing. Indeed, artificial intelligence and the information-processing model of the mind owe more to Piaget than its proponents may realize.

The core of Piaget is his belief that looking carefully at how knowledge develops in children will elucidate the nature of knowledge in general. Whether this has in fact led to deeper understanding remains, like everything about Piaget, controversial. In the past decade Piaget has been vigorously challenged by the current fashion of viewing knowledge as an intrinsic property of the brain. Ingenious experiments have demonstrated that newborn infants already have some of the knowledge that Piaget believed children constructed. But for those, like me, who still see Piaget as the giant in the field of cognitive theory, the difference between what the baby brings and what the adult has is so immense that the new discoveries do not significantly reduce the gap but only increase the mystery.

M.I.T. professor **Seymour Papert**, creator of the Logo computer language, worked with Piaget in Geneva.

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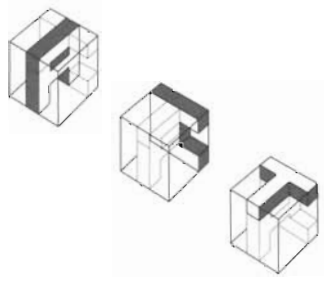

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