

## **Stalking the “Fuzzy Sunshine Seeds”: Constructivist Processes for Teaching about Constructivism in Teacher Education**

**By Penny Oldfather, Suzann Bonds, and Tara Bray**

Six year old Emily was describing what she had learned about photosynthesis. She explained that plants need sunlight, and that sunlight comes in through the leaves of the plant. But when Emily described how this process occurs, we found that her notion of photosynthesis was not what we expected. This was her hypothesis: Fuzzy sunshine seeds fly down from the sun and swirl around the plants. They fall on the leaves. By the next morning these wonderful sunshine seeds soak into the leaves. That is how plants use sunshine to grow and make food.

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*Penny Oldfather is an assistant professor in the Department of Elementary Education and a principal investigator with the National Reading Research Center, School of Teacher Education, College of Education, The University of Georgia, Athens; Suzann Bonds and Tara Bray are teachers in the Gwinnett County Public Schools, Georgia.*

This conversation with Emily came about as part of what we have called a **children’s thinking project**. The project, which was part of a Master’s level course in early childhood education, was designed to deepen our understanding of constructivism, and its implications for teaching. This article was written as a collaboration between two class members and the professor who taught the course, and is presented as a case study. The professor’s role throughout the

children's thinking project, and in the writing of this paper, was as a co-learner, exploring ways to make constructivism come alive in teacher education.<sup>1</sup>

We will describe the conceptual framework for the project, and the purposes and structure of the children's thinking project. Secondly, we will report what we learned about gaining access to children's ideas, and our insights into their thought processes. Finally, we will address how this project has affected our thinking about teaching and learning, particularly our understanding of constructivism, and the implications of our findings for teacher education. In our multiple and overlapping roles as teachers, researchers, and learners, we experienced "the having of wonderful ideas" (Duckworth, 1987), as we explored constructivist processes. In becoming more aware of our own construction of meaning, we have gained a deeper understanding of our students' learning processes.

### **Constructivism and Teacher Education**

Epistemological issues are critical for teacher education. They guide (or should guide) the program design, curriculum, methodology, and approaches to program development, as well as the power structures of programs (Beyer, 1989; Tom, 1984; Zeichner & Liston, 1987). In turn, the design of the program will affect the epistemological views and the roles assumed by teacher education students and faculty, and ultimately have major impact upon the day-to-day experiences of children in the nation's schools.

In spite of the importance of epistemological issues in education, they have remained, until recently, mostly unexamined and invisible. The default mode in education has been an empiricist/reductionist approach to teaching and learning (Heshusius, 1989; Poplin, 1988). Fosnot (1989, p. 18), for example, described the dominant approach to curriculum planning:

Fields are isolated and categorized as if they were really separate entities (e.g., science, math, reading), and then they compete with each other for time in the overall curriculum. Subskills are identified and sequenced into pre-planned curricula. Learners are diagnosed, motivated, reinforced, and posttested. Again, we see the role of the teacher as a technician who assesses the needs of the learner and then presents the "correct" prescribed sequence of objectives in the "correct" instructional mode.

This tell-me/show-me approach is mirrored by (and arises from) many teacher education programs (Lanier & Little, 1988). Friere (1971) refers to this traditional approach as the "banking" model. The role of the teacher is "to 'fill' the students by making deposits of information which the teacher considers to constitute true knowledge" (p. 63). The role of the student is to store the deposits.

In contrast to the banking metaphor, a constructivist metaphor for teaching is the teacher as midwife.

## *Oldfather, Bonds, and Bray*

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The midwife-teacher's first concern is to preserve the student's fragile newborn thoughts, to see that they are born with their truth intact.... Midwife-teachers focus not on their own knowledge (as the lecturer does) but on the students' knowledge. They contribute when needed, but it is always clear that the baby is not theirs, but the student's (Belenky, Clinchy, Goldberger & Tarule, 1987, p. 218).

As a Piagetian constructivist, Duckworth (1989) considers the essence of intellectual development as "the having of wonderful ideas." She has argued that the most important lessons from Piaget do **not** have to do with designation of stages, or how to accelerate the development of children's ideas. Rather, the critical concern is that teachers need to learn how to assume a posture of "being Piaget" (Duckworth, 1989, p. 87). As Duckworth (1989) asserts:

The main thing...is the focus on how children are making sense of the situation **in their own way**.... To the extent that one carries on a conversation with a child, as a way of trying to understand a child's understanding, the child's understanding increases in the very process. (p. 96)

Further, Duckworth asserts that in order for teachers to be able to move toward a posture of creating the opportunities for students to have wonderful ideas (i.e., to construct meaning), teachers need to learn through the same processes that their children will be learning. Fosnot (1989) affirms Duckworth's position, suggesting that

teacher candidates themselves need to be immersed in an environment where they are engaged in questioning, hypothesizing, investigating, imagining, and debating. They need to be part of a community that actively works with them as **learners** and then allows the experience to be dissected, evaluated, and reflected upon in order for principles of pedagogy and action to be constructed. (p. 21)

This was part of the framework within which the children's thinking project was designed and carried out. Although all of the class members remember having memorized Piagetian stages of cognitive development in previous courses, few had found deep relevance of Piaget's research for teaching. We "remembered" the stages at least long enough to pass an exam. What we had not gained in the past was an understanding of the relevance of the principles of constructivism to the processes of learning and teaching in our classrooms. In short, we had been presented with Piagetian constructivism in a non-constructivist manner that violated the theory itself. Several of us had worried about the dilemma presented by Duckworth (1987, pp. 31-49) in her essay, "Either We're Too Early and They Can't Learn It, or We're Too Late and They Know It Already."

Although our project draws from Piagetian constructivism, represented in the work of Duckworth (1987) and Fosnot (1989), our views of constructivism are also informed by a social constructivist view of learning. For example, not only do we see knowledge as invention, as a process of construction that takes place as an

organic process, we also believe that knowledge construction is facilitated through social interactions, and that concept development proceeds from interpersonal to intrapersonal (Vygotsky, 1978). Thus, the role of “the more knowledgeable other” (Wood, Bruner, & Ross, 1976) becomes critical in introducing new ideas and scaffolding the understandings of the learner. Language is at the heart of learning. The children’s thinking project was undertaken to facilitate graduate students’ understandings of these views of learning as socially constructed.

### **The Children’s Thinking Project**

In conducting the children’s thinking project, class members became researchers. The assignment was to conduct one or more informal taped interviews with children, exploring a child’s underlying conceptual structures. Other goals were to examine the structure of children’s logic, and to develop our skills in “getting into a child’s mind” through conducting and reflecting upon interviews with children. The focus was to find out as much as possible about what a child **really understood** about a natural phenomenon or other topic. We were interested not so much in whether the student had particular vocabulary and could use the “right words,” but whether the child had a grasp of the deeper concepts of the processes involved.

The primary purpose of the children’s thinking project was **experiential**; that is, our main goal was **not** to collect data about children’s concept development. Rather, the purpose was to enable participants who conducted the project to gain insights about constructivism. Each researcher determined which topics to explore in the interviews. Some based their choices on particular interests of the child, or context of the interview.

In preparation for the children’s thinking project, class members read materials about observing children (Almy & Genishi, 1979), and about constructivism (Duckworth, 1987; Fosnot, 1989; Poplin, 1988), among others. This frame of readings and class discussion established the backdrop for interpreting the experiences gained through the interviews. To develop interviewing skills, we read aloud, in a readers’ theater style, transcriptions of research interviews with children. We analyzed the researcher-student interactions in the interviews, noting techniques that seemed to be effective for encouraging children to describe and elaborate their ideas, and considering alternative responses which the interviewer might have used.

The project was approached inductively as an open-ended investigation. The instructor presented only general guidelines, placing a great deal of responsibility on students to determine the format, approach, and topics for the interviews. Although some of us found this freedom unsettling, we believe it forced us to be more creative in our approaches, and enabled us to use our individual strengths.<sup>2</sup>

After conducting and analyzing the interviews, each person wrote a short paper describing the interview context, approach, content, findings and a summary of what was learned, as well as a self-critique of successes and/or problems as an

interviewer. Consistent with constructivist principles, emphasis in the analysis was placed not on **avoiding** errors, but on **learning** from them. The papers were presented in class, with lively discussion resulting as we shared our experiences and findings, and considered what this all meant for our understanding of teaching and for teacher education.

Although we had each approached our projects differently, there were many commonalities in the children's thinking and responses, as well as in what we discovered about successful interviewing practices. We got a glimpse of what it means to "think like Piaget." That is, we began to understand how it feels to "take off our teacher hats" and to probe children's constructions of meaning. We discovered that many of the interviewing skills we were practicing had important applications for teaching children. We developed greater clarity about what it means to construct meaning through our own heightened metacognitive awareness that took place through the inquiry of the children's thinking project.

### **Probing Children's Thinking: What Worked for Us**

Out of our mutual sharing and critiques, the class identified several elements that contributed to successful interviews. All of us tried to put the interviewee at ease in a pleasant and relaxing setting. Many of us began our interviews with general questions about the child's recent activities or current interests.

We made an effort to assure the children that the purpose of the interview was not to test them on having the "right answers" but rather to learn about **their** ideas and theories about things. We tried to convey that it was safe to say anything they felt. This was attempted through words, body language, and facial expressions.

Although several of us had prepared a format for the interviews, most of us found that when we set aside our notes and questions, and concentrated on the student's responses, the interviews took on more depth. "How" and "why" questions in response to students' comments encouraged elaboration and deeper thinking. Children shared detailed explanations as they responded to questions like "How does food get into your blood and bones?" and "Why does it rain?" One interviewer asked a child to complete specific Piagetian tasks. She was able to observe the child's processes on the task, and used probing questions about how and why he chose to do certain things.

We found several techniques helpful in keeping the conversation flowing. Repeating the children's own words, asking the same question in another form, elicited students' ideas. As interviewers, we assumed the role of co-learner with the child, expressing interest and wonder at the explanations. "Tell me more about..." and "Why do you think that...?" when asked with a positive and curious tone, enabled the children to elaborate even further.

Perhaps the most difficult, but most critical aspect of our interview strategy was to allow substantial "wait time" for the child's responses. In critiquing our interview

tapes we discovered that we had often allowed inadequate response time. We became much more aware of how long it takes children to process information. What seems like a long time to the teacher researcher may be a short time for a child who is trying to organize and express his thoughts.

We learned that we need to talk less and listen more actively, if we want to discover how a child thinks and formulates knowledge. This required a rethinking of our roles as teachers, moving away from being disseminators of information, becoming facilitators, listeners, and co-learners. We saw a parallel between the experience of freedom we felt throughout the children's thinking project to learn in our own ways, and the children's experiences of exploring their own ideas in the interviews. It is exciting when you realize that you can figure something out for yourself, whether you are four years old, or forty years old.

### **Insights into Children's Thinking**

As we explored children's ideas about natural phenomena through the children's thinking projects, we became aware that in the past we may have unknowingly presented curriculum to children for which they were not conceptually ready. We will elaborate below how we came to these conclusions.

In previous courses, we had learned about Piaget's concept of conservation, but not until this project had we really understood practical relevance for early childhood curriculum. Through our interviews, we observed that the inability to conserve frequently appeared to prevent a child from grasping a concept. For example, in order to conceptualize the water cycle in which molecules change from liquid to vapor, a child needs to be able to conserve. Children may be able to learn the vocabulary of evaporation and condensation, but we should not assume that they can understand the meanings. Emily's "sunshine seeds" described earlier exemplify her struggle to make sense of the abstract idea of photosynthesis without having conceptual readiness.

When the children were not conserving and were not ready to understand a concept, they often made up their own explanations. For example, six year old Lesley had her own explanation for digestion processes. She hypothesized that after we swallowed our food, the pieces floated on top of the blood in the veins to the bones where it "melted" into them. She understood that the blood had something to do with getting food to body parts, but as a kindergartner she wasn't sure how the process worked, so she "filled in" with her own understandings.

Many of the children offered theological explanations when they were not able to understand something. Four children explained rain theologically. Jessica reported that "Rain occurs when the devil and God are fighting. The sky is clear when they are at peace." Jerome said that rain comes because "God's taking a shower." Cody also believed that "Rain comes from God. God says, 'Abracadabra!', And it rains!" Adam declared, "And God says, 'Let there be rain.'" Some

of these expressions may have been original, others may have been learned from parents or others. We did not probe their authority or sources in this setting, because our purpose was to avoid communicating a judgment about right or wrong answers.

Several interviews revealed children's efforts at deductive reasoning as they tried to understand the world. There were many examples in which children attempted to draw from their previous knowledge and experience, in order to explain things. David, a six year old whose family golfed a good deal, reported that it did not snow in Georgia in the winter, because if it did, the people couldn't play golf. He added that Georgia is very close to Florida, and Florida never gets snow "because that is where the beach is, and God only puts beaches where it is warm." David believed in a generous universe! On the other hand, he was using an interesting sort of logic in thinking about distance in relation to time required to travel: Indiana was a "night's sleep from Georgia."

It was only through our interviewing posture as **co-learners** rather than teachers that we were able to discover how these children constructed explanations about their world. If children had felt we were after a particular "right" answer, they might not have been likely to hypothesize. Five-year old Thomas wandered by a duck pond with his interviewer and hypothesized about how ducks float. He first explained that the duck's special feet make him float, and that the duck has to move his feet very fast to stay on top of the water (applying advice about swimming presented by his father). As the ducks floated very near, Thomas was able to see the feet paddling very lazily in the water, and commented, "Hey! Their feet are not moving fast!.... I don't know." After that, Thomas did not want to talk about the duck anymore. (It is hard, sometimes, when you have to give up your theory!) He was drawing from his prior, but incomplete, knowledge, trying to make sense of the swimming of ducks. He was a budding, but somewhat discouraged, small scientist. We could identify with Thomas. We remembered times when we had not felt successful and wanted to give up. This dialogue has powerful implications for the classroom. When there is always pressure to provide only one right answer, and children do not readily come up with it, they may stop thinking and become disinterested. Through asking open-ended questions, we may be able to encourage continued thinking and risk-taking.

## **Implications and Insights for Teaching and Teacher Education**

In the following section we summarize understandings gained for our teaching, and thereby illustrate the value of the children's thinking project for teacher education. We propose further applications for courses for teacher education. This experience has dramatically affected the way we think about our teaching and learning. We made personal discoveries about the nature of children's thinking, and the importance of moment to moment assessment of their understandings, which we

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feel necessitates a shift in our roles as we try to “think like Piaget.”

We have become more sensitive to the importance of posing questions that are open-ended and that are appropriate for children’s conceptual levels. We feel more strongly about giving children freedom and time for self-expression, and to let them experience what Oldfather (1993; Oldfather & McLaughlin, 1993) describes as “sharing the ownership of knowing.” Children experience a greater sense of agency as they find that knowledge is not solely the domain of teachers or other adults, but that **they** can think, **they** can know, **they** can experience, as Duckworth (1987) suggests, the “having of wonderful ideas” (Oldfather & Dahl, in press).

Further, in evaluating what we have learned through the children’s thinking project, we have asked serious questions about our sometimes hurried, fact-driven curriculum. We understand with new clarity that just because we have “covered” concepts, does not mean that students understand them at a deep level. Only when ideas have been internalized by children into their own frameworks of understanding are they able to articulate them in a clear way. We became aware of how we can use casual conversation to probe children’s understandings of what we hope to be teaching them in school. We want to become more aware of the hypotheses that children pose about the world as they struggle to understand phenomena that require conceptual structures beyond their present development. We hope to become more skilled in identifying the gaps in understanding and creative misconceptions lingering in the minds of our students who are not ready for particular concepts.

Our means of assessing students’ understandings also merit scrutiny in light of our findings. We have become acutely aware that students may parrot right answers without understanding the concepts behind them. Multiple choice tests alone are inadequate tools for assessing higher levels of comprehension. We intend to move toward a variety of alternatives for assessment, including interactive modes in small and large groups, learning logs, student self-evaluations, and open-ended questions. Out of our experience with the children’s thinking project, we have determined that we want to have on-going interviews with our students.

Experiencing learning as teacher researchers in conducting the children’s thinking project has helped us build a bridge between theory and practice. We have begun to overcome what Boomer (1987) described as the “elsewhereness” of knowledge. Our experiences in conducting and reflecting on the interviews during the children’s thinking project facilitated new understandings of constructivism and its implications for our classrooms and for teacher education.

We felt intensely involved in “the having of wonderful ideas” (Duckworth, 1987), becoming more aware of how our students might experience the construction of meaning. The collaborative aspects of the process were especially important because of the insights gained as the class members compared and contrasted the content and processes of our interviews with one another. We feel more confident about entering the minds of children, and facilitating their explanations of the world. We return to our classrooms to begin the process of experimentation and



reflection, applying what we have learned through this constructivist process of learning about constructivism.

Teacher preparation programs that propose to reflect constructivist principles may find a powerful means of modeling and enhancing constructivist understandings through projects such as this. When incorporated into methods courses in content areas, similar projects can be conducted to deepen teachers' understanding of how children construct meaning in language, science, economics, mathematics, and other arenas of knowledge. This understanding will promote their ability to become effective in scaffolding children's conceptual development in the content areas.

As teachers move toward deeper understanding of constructivism, they reconceptualize their roles from those of disseminators of knowledge to facilitators of children's understandings. Teacher educators continue to search for means by which this process can be modeled and facilitated. The children's thinking project offers one more piece to the puzzle of how we might move toward this transformation.

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### **Notes**

1. Acknowledging that constructivist theorists have discriminated among many different notions of constructivism, this article will not address those differences within the limited space allocated.
2. The voice changes here to reflect primarily the public school teacher-authors of the article.

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