

# What Does Research on Constructivist Education Tell Us about Effective Schooling?

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## **Abstract**

The two most central conceptions underlying constructivist education are that (1) children construct knowledge, and (2) children cannot become autonomous intellectually or morally in authoritarian relations with adults. With its roots in progressive education, the constructivist approach is described in terms of academics and social and moral education. Research on the effectiveness of constructivist education is reviewed. Studies included are (1) those that compare constructivist and non-constructivist classrooms, and (2) those that compare democratic and authoritarian teaching styles. Eight studies are described. Results include assessments of standardized tests of mathematics and language, reading and writing, social behavior, interpersonal understanding, sense of community, commitment to democratic values, conflict resolution skill, positive interpersonal behavior, marijuana and alcohol use, academic motivation, academic self-esteem, engagement in class, arithmetic knowledge and logic, moral judgment, complexity of ideas, aggression, seriousness of work atmosphere, morale, and success in college. These results indicate better child outcomes for constructivist as compared with non-constructivist classrooms. Further, the better the constructivist implementation, the better the child outcomes.

Practical implications for schools are discussed. Results suggest that schools should not undertake a constructivist program without the seriousness of purpose and dedication necessary to achieve the good implementation that produces good child outcomes. Constructivist education is not easy to implement, and the process of becoming a constructivist teacher takes at least 2-3 years. This process should begin with an emphasis on the first principle of constructivist education: To create a sociomoral atmosphere of mutual respect that is continually practiced.

An increasing number of Iowa teachers are implementing constructivist education in their classrooms. Those interested in seeing an implementation in early education (for children 3-7 years of age) may contact the author (319-273-2101 or 319-287-9415) to make arrangements to visit the Freeburg Early Childhood Program in east Waterloo, operated under the auspices of the Regents' Center for Early Developmental Education at the University of Northern Iowa.

## **What Does Research on Constructivist Education Tell Us about Effective Schooling?**

Interest in constructivist education has been sweeping the country, and while teachers across the nation (and beyond) are implementing this approach, it is still far from common. The purpose of this paper is to (1) consider briefly the central concepts of constructivist education, (2) describe what it looks like in practical terms, and (3) summarize research bearing on the constructivist tenet that a cooperative classroom atmosphere combined with active, constructivist curriculum results in optimal development and learning.

To give a brief definition, constructivist education appeals to children's interests, engages them in experimentation with phenomena of the physical world, and fosters cooperation between teacher and child and among children (DeVries & Kohlberg, 1987/1990). The most valued assessments of children's knowledge are found in their work rather than in tests. The constructivist teacher is a mentor who takes a cooperative attitude in relation to children and uses natural and logical consequences as alternatives to authoritarian discipline.

### Conceptions Central to Constructivist Education

The two most central conceptions underlying constructivist education are the following:

1. Children construct knowledge;
2. Children cannot become autonomous intellectually or morally in authoritarian relations with adults.

Let us briefly consider what these mean.

#### Children Construct Knowledge

A constructivist orientation is one in which the child's subjective experience must be taken into account in all educational efforts because the child is understood as the active constructor of knowledge, personality, and morality. Constructivist education gets its name from Jean Piaget's theory that children construct these characteristics. The research evidence (for example, Piaget, 1932/1965; 1936/1952; 1929/1960) shows that children have many ideas that are not taught to them. For example, three-year-olds often use their intelligence to reason that their shadows go inside themselves when they cannot see them. Five-year-olds often believe their shadows are under their bed or covers at night (DeVries, 1986; Piaget, 1929/1960). Even 9-year-olds do not believe that shadows are transitory. Rather, they are convinced that unseen shadows are still there somewhere (DeVries, 1986). No one ever taught these ideas. They are the

product of thinking about causes that are not easily observed. No amount of direct teaching of the facts can convince children otherwise because these are beliefs about non-observables that cannot be disproven. Teachers who require children holding such beliefs to verbalize the correct answers short-circuit the constructive process. Children may learn that what adults say makes no sense and that adults want them to parrot what is meaningless to children. This can make the child lose confidence in his or her own thinking and take on a passive intellectual attitude. To continue the earlier example, children construct their knowledge about shadows over a rather long period from age two through adolescence. Correct ideas about shadows are the result of logical deductions that allow the child to correct erroneous ideas. However, this does not mean that teachers can do nothing to promote children's construction of knowledge about shadows. Constructivist teachers do not take a maturationist view that they must simply wait until the child is "ready." What teachers can do is give children many experiences in which they experiment with making shadows in order to test their ideas and develop reasoning power and confidence in the power of their reasoning. Teachers can also ask questions (such as "What do you think will happen if. . .?") to produce a disequilibrium – a contradiction between what children expect and what actually happens in the course of their experimentation. Teachers can facilitate discussions in which children invariably have differing ideas about the causality of shadow phenomena and thus encounter further disequilibria. The child's puzzlement over various contradictions and personal struggles to resolve these contradictions gradually lead to spontaneous deductions in accord with scientific truth, more solid and permanent because they are the result of the child's own reasoning. Constructivist educators do not expect young children to construct these truths and coherent logic quickly or to understand scientific truths as adults do, but do expect children to think and reason about phenomena in ways that will eventually lead them to construct the truths. From a constructivist perspective, such reasoning leads children to become more intelligent. When constructivists talk about constructing knowledge, they are referring both to the content of knowledge (for example, properties of objects or relative values of numbers) and to the structure of knowledge (for example, the understanding of relationships such as transitivity, seriation, and correspondence). Constructivists take the view that it is through active reasoning that both content and structure are constructed simultaneously.

Just as children construct over a considerable period of time their knowledge and reasoning about the world of objects, they also must construct knowledge and reasoning about the world of people. For

example, we want children to construct the moral conviction that they want to treat others as they themselves wish to be treated. This occurs as a result of observing how their actions affect others, how others' actions affect them, and comparing positive and negative actions and reactions. In the course of constructing knowledge about the world of people (which can be functional or dysfunctional), they are also constructing knowledge about their own competencies and incompetencies, the reliability of others, and how to relate to others.

Children Cannot Become Intellectually and Morally Autonomous in Authoritarian Relationships with Adults

Piaget's (1932/1965) research and theory convinces constructivist educators that a particular type of adult-child relationship is necessary for children's optimal development and learning. Piaget proposed a conception of two types of morality, heteronomous and autonomous, and two parallel types of adult-child relations, coercive and cooperative, that differ in their effects on children's learning and development. Heteronomous morality is a morality of obedience in which the individual simply accepts and follows rules given by others. Autonomous morality is following moral rules with a feeling of personal necessity, conviction, and commitment. Piaget defined the heteronomous or coercive relationship as one in which the child is regulated by the adult who gives ready-made rules and instructions for behavior. In this relationship, the adult uses the power of authority to control and instruct the child, and the child's reason for behavior is outside his or her own reasoning and system of personal interests and values. In contrast, the autonomous or cooperative relationship is one in which the adult builds on a foundation of mutual affection to encourage the child's self-regulation and the construction process of moral rules and values that guide behaviors.

Constructivist educators take the view that autonomous morality results from self-regulation as children deal with social, moral, and intellectual problems in their lives and find out what happens when they take certain actions. Self-regulation is therefore considered to be necessary for optimal development and learning. Heteronomous, coercive control by adults results in intellectual passivity when children submit mindlessly to adults. Thus, according to Piaget (1932/1965):

If he [the child] is intellectually passive, he will not know how to be free ethically. Conversely, if his ethics consist exclusively in submission to adult authority, and if the only exchanges that make up the

life of the class are those that bind each student individually to a master holding all power, he will not know how to be intellectually active. (p. 107)

The practical implications of these ideas are discussed below.

#### What Does Constructivist Education Look Like?

Constructivist education is not entirely new. It stands on the shoulders of progressive educators who believed that interest is key to children's learning (for example, Dewey, 1913/1975) and who learned through action research how to inspire young children to pursue their interests in content that is worthwhile (Mayhew & Edwards, 1936; Read, 1966; Tanner, 1997). Let us consider academics and social and moral development.

#### Academics

In constructivist academics, the goal is not only to learn the content of academics but also to provide activities that increase children's possibilities for developing self-regulation and reasoning. To the extent possible and practical, teachers offer children choices of activities. In early education, teachers provide blocks, books, balls, jump ropes, puzzles, etc., in which children are intrinsically interested. Constructivist educators add to the traditional child development curriculum in early education activities such as physical-knowledge (science) activities (such as catapults and ramps) and group games with rules (such as High Card and Dominoes) (Chaille, 1997, Forman & Kushner, 1983; Kamii, 1989, 1994, 2000; Fosnot, 1989, 1996; and Kamii & DeVries, 1978/1993, 1980), and modify many old activities. Older children have opportunities to pursue chosen academic interests through projects and activities that respect school district and national standards and go beyond them. While the teacher must take responsibility for making sure that each child acquires certain competencies and knowledge (such as arithmetic calculation and certain historical events), he or she has wide latitude with regard to how to accomplish this objective. At some times, children are allowed to choose within district- or teacher-made boundaries (for example, math games), at some times children have only a little choice (for example, when to do a mandated handwriting task), and at some times, they have no choice at all (for example, whether to participate in some sort of mathematics activities). The teacher provides guidance on how children explore chosen topics, and children share with one another the results of these efforts. This may be through presentations to the class, exhibits, putting on a play, or other ways of displaying what they have learned. Constructivist theory

makes it possible for us to deepen our understanding of how activities such as these promote children's development and learning.

Academics in constructivist classrooms are integrated in a program where children work together in large or small groups or alone. The emphasis is on promoting reasoning along with subject-matter knowledge and integrating assessment with observation of children in activities. Rows of desks are usually absent from a constructivist classroom, and the room is organized to make children's experimentation and investigation possible (for example, large spaces for experimenting with the physics of pendulums, spaces for cooking, etc.) and to accommodate large group class meetings in which children deal with how they want their class to be and problems that inevitably arise in an active classroom. A constructivist teacher is especially gratified when, for example, a second-grader whose interest has been captured by a new topic exults with awe, "We can go the library and do research!"

#### Social and Moral Education

Children's convictions about interpersonal relations develop when children have the opportunity to reflect on social and moral problems in their lives, make mistakes, experience their consequences, and develop their own reasons for following rules. DeVries and Zan (1994) propose that the teacher-child relation fostering autonomous morality is one in which the teacher cooperates with children by encouraging them to make classroom rules, develop strategies for resolving conflicts with others, and reflect on social and moral issues in literature and in the classroom.

In a constructivist classroom, discipline is especially linked to moral and intellectual goals. In order to promote autonomy and prevent an overbalance of heteronomy, constructivist teachers consciously monitor their interactions with children. Authoritarian demanding, emotional intimidation, and arbitrary punishments have no place in a constructivist classroom. Neither do passive permissiveness or "letting children run wild"—that is, failing to take action when rules are broken and when children engage in unsafe, aggressive, or defiant behaviors. The first principle of constructivist education is to create a sociomoral atmosphere in which mutual respect is continually practiced. This means that *unnecessary* external control, punishment, and excessive praise are absent. Rather, logical consequences (in which the consequence has a logical, non-arbitrary relation to the misdeed) impress upon children the results of their actions, with the goal of the construction of moral convictions. The teacher often consults with children

about what will happen in the classroom and engages them in consensus building and making classroom rules. Thus, constructivist programs may be said to be democratic in nature.

While coercion may often be necessary (see DeVries & Zan, 1994; DeVries, Hildebrandt, & Zan, 2000; DeVries, Zan, & Hildebrandt, in press), the constructivist teacher constantly asks, “Is this coercion necessary?” and strives for much more cooperation than coercion. When it is necessary for the teacher to be coercive, it is important to explain the reasons for the coercion in ways that children can understand. When it is not possible for the child to understand, the teacher must call upon the child’s good will and affection as a basis for complying with a teacher’s necessary request.

#### Research on the Effectiveness of Constructivist Education

Studies of most relevance to the evaluation of constructivist education are (1) those that compare constructivist and non-constructivist classrooms, and (2) those that compare democratic and authoritarian teaching styles. These are discussed below with reference to theory, practice, and research. Each study reviewed here includes a measure of program implementation that assures us that the programs studied differ in implementation and show evidence of characteristics of the label that identifies them. Studies are included only if they address the relationship between child outcomes and the sociomoral atmosphere, teacher behavior, or overall constructivist curriculum. Thus research on pupil control ideology (such as Willower & Jones, 1963; Willower, Eidell, & Hoy, 1973) is omitted because the study of teacher behavior is not included in those studies, and student outcomes are not assessed (except for one study, [Schmidt & Jacobson, 1989], that notes a relationship between humanistic ideology and child self esteem). Omitted from this review is the considerable literature on parenting practices that also offers evidence pertaining to the general issue (consistent, by the way, with the results of studies in schools; see Baumrind, 1971, 1989; review by Maccoby & Martin, 1983). Also omitted from this review are studies of cooperative, competitive, and individualistic organization of learning activities. While this research bears on the broader issue of self-regulation and shows cooperative group work to be superior to competitive and individualistic work (see Johnson & Johnson, 1999, for example), this work does not provide data on teacher behavior related to coercive and cooperative teacher-child relationships or to a comprehensive constructivist program.

### Constructivist versus Non-Constructivist Programs

While elements of constructivist education have been advocated and implemented in the past, especially in programs influenced by John Dewey's philosophy, programs labeled as constructivist are of fairly recent origin, and research has only begun to appear. Six researchers or teams provide evidence on the effectiveness of constructivist programs.

1. Pfannenstiel and Schattgen's study of Missouri's Project Construct;
2. Morse's study of Project Construct children in third grade;
3. Developmental Studies Center's research on its Child Development Project schools;
4. Kamii's study of children's understanding of arithmetic;
5. DeVries's study of interpersonal understanding in constructivist, behaviorist, and eclectic classrooms;
6. Araujo's longitudinal study of children's moral judgment.

These are discussed below.

#### Pfannenstiel and Schattgen

The largest study of constructivist versus non-constructivist education is by Pfannenstiel (1997) and Pfannenstiel and Schattgen (1997; Project Construct, 1998) who focus on Project Construct classrooms in Missouri where the state Department of Elementary and Secondary Education since 1986 has adopted constructivist education for statewide implementation (although it is not mandatory). Approximately 3,500 educators preschool through grade five currently implement Project Construct in Missouri. In the Pfannenstiel and Schattgen study, 2,200 questionnaires on teacher beliefs were gathered, and 120 teachers were randomly selected to include 40 constructivist kindergarten teachers, 40 traditional non-constructivist teachers, and 40 with teacher beliefs falling in the middle. To validate the classroom classifications, these classrooms were observed and rated on a 144-item Classroom Learning Environment Scale designed to assess comprehensively characteristics of constructivist education. Pfannenstiel (1997) described traditional teachers as those who, for example, used worksheets and flash cards to teach and assess skills, used "centers to reward children for completing their work rather than as a place for doing work" (p.2), and gave little opportunity for child-directed learning and play. Data on the achievement of 2,346 students were collected at the end of the kindergarten year. The 120 teachers used a comprehensive 115-item rating scale, the Student Observation Record, that was created to assess students' learning across the domains of social

relationships, dispositions, mathematical knowledge, physical knowledge, conventional knowledge, symbolic development, listening and speaking, reading, and writing. A representative sub-sample of 185 students in the constructivist and traditional classrooms took standardized, paper-and-pencil achievement batteries. A randomly selected sub-group of 88 students responded to performance tasks that measure specific mathematical and language goals.

Findings from this study show that children from constructivist classrooms were significantly more advanced than were children from traditional classrooms on performance tests of classification, writing, reading, and social behavior. They were also significantly higher on standardized tests of mathematics and language. In constructivist classrooms, poverty did not predict children's learning except in the area of arbitrary conventional knowledge (such as the names of objects). In authoritarian teacher-directed classrooms, higher poverty was associated with lower achievement on standardized tests of mathematics and language while in constructivist child-centered classrooms, higher poverty was associated with higher achievement in these domains. The overall conclusion is that:

Students whose teachers employ pedagogy based on constructivism attain higher levels of achievement than do students whose teachers use practices rooted in traditional beliefs about learning. Students in traditional classrooms do not outperform students in constructivist classrooms on any measure. . . . The extent to which the learning environment is teacher-directed is the single best negative predictor of standardized mathematics and language achievement. (Project Construct, 1998, p. 9)

Pfannenstiel (1997) summarized, stating “kindergarten children in constructivist classrooms are much more educationally advantaged than their peers in traditional classrooms” (p. 7).

### Morse

Morse (1995) also focused on children in Missouri by studying attitude, efficacy, and school achievement of 24 children from three second-grade classrooms who experienced constructivist education preschool through grade two and then went to nine non-constructivist third-grade classrooms. They were compared with 26 second-grade classmates in three other classrooms. The two groups were almost identical in racial and gender characteristics. Data were collected at the end of the second and third grades. The question addressed in this study was “How well do children coming from constructivist programs achieve academically and socially once they enter the mainstream of traditional education?” (Morse, 1995, p. 8). A

self-report Teaching Styles Questionnaire administered to teachers provides a measure of implementation. Non-constructivist teachers reported greater use of basal series in teaching subject matters, teacher-determined content taught to the group as a whole, and evaluation of children through worksheets, tests, and grades. The constructivist teachers reported greater use of integrated curriculum, active learning centers, encouragement of children's participation in making classroom decisions, and an evaluation process shared by teachers and children.

Constructivist children at second grade scored at or above the national average in total reading, total mathematics, and total basic battery of the Stanford Achievement Test, and they maintained these levels at the end of third grade. No significant differences in achievement were found between constructivist and non-constructivist groups at the end of third grade. Morse comments:

The greater emphasis on testing by the non-constructivist teachers did not produce significantly higher test scores. . . nor did the lack of emphasis on testing at the constructivist school produce lower scores” (p. 87)

Surprisingly, despite children's equal achievement test performance, the non-constructivist third-grade teachers rated constructivist children lower on classroom achievement. Morse (1995) speculates that non-constructivist teachers may have expected “questions and responses demonstrating isolated facts and skills rather than the more divergent thought processes encouraged by the second-grade constructivist teachers” (p. 90). Children's self-report ratings of their Subject Area Competency, Questioning Ability, and Social Problem Solving Ability dropped, but not significantly so, from grade two to grade three. Children's rating of their Enjoyment of School did not drop. However, children's ratings of their Problem Solving Ability did drop significantly from grade two to grade three. Morse interprets this trend as a decrease in feelings of efficacy at grade three. Perhaps this drop reflects a reaction to teachers' communication of their lower assessments of constructivist children's classroom achievement, despite achievement-test performance equal to that of children from non-constructivist classrooms. Or, it could be that fewer problems significant to children are available to solve in non-constructivist classrooms.

#### Developmental Studies Center

The Developmental Studies Center (DSC) in Oakland, California, works with school districts on implementing their Child Development Project (CDP), a constructivist approach that emphasizes children's

sense of community and focuses on cooperative methods of teaching children to work together. An essential goal is for the teacher to create a caring community of learners that “meets children’s basic psychological needs for autonomy, competence, and belonging” (Developmental Studies Center, 1998, p. 2). Self-regulation is seen in DSC’s emphasis on intrinsic motivation, self-direction, and self-assessment. This constructivist approach also emphasizes children’s decision-making and rule making, the discussion of social and moral issues in children’s literature, and prosocial behavior. Major components of CDP are described as follows:

A literature-based approach to reading and language arts that stimulates children’s enjoyment of reading and encourages them to think deeply about what they read, while helping them build empathy for others and values such as fairness, responsibility and caring;

A cooperative approach to classroom learning that emphasizes the importance of challenging and meaningful learning tasks, the benefits of collaborating on learning tasks, and the importance of learning to work with others in fair, caring, and responsible ways; and an approach to classroom management and discipline that builds a caring community in which all students are treated with respect and have opportunities to develop and exercise positive interpersonal skills, and which uses problem solving and an emphasis on intrinsic motivation (rather than rewards and punishments) to develop student responsibility and competence. (Developmental Studies Center, 1998, p. 1)

DSC also includes a Schoolwide Component focused on building a caring community throughout the school (for example, a Buddies Program pairs younger and older students, and Grandparents’ Day provides an opportunity to expand cultural understanding). In addition, a Family Component increases the meaningful connection between parents/families and school (for example, Family Film Nights and Homeside Activities for children and their families).

DSC contracted with school districts to provide staff development for teachers of kindergarten through grade 8. Numerous studies on the effectiveness of the CDP have been conducted. Here the focus is on a report summarizing three studies (Developmental Studies Center, 1998). The three studies involved (1) 300-350 children, kindergarten through fourth grade, who experienced the CDP in three randomly-assigned elementary schools in San Ramon, California, and three comparison schools that wanted to participate in the project; (2) 181 diverse, socioeconomically disadvantaged children fourth through sixth grades in two

(non-randomly assigned) Hayward, California CDP schools and two comparison schools, and (3) children in 134 classrooms, grades three through sixth, in six districts in California, Kentucky, Florida, and New York. Strong assessment of program implementation is a feature of these studies. Findings can be summarized as follows:

1. Students of teachers who gained in implementation over the project years showed clear gains in their sense of the school as a community;
2. Students of teachers who gained in implementation consistently showed positive changes in a range of attitudes, inclinations, feelings, and behaviors. These included commitment to democratic values, sense of community, social and ethical attitudes, conflict resolution skill, concern for others, trust in and respect for teachers, prosocial motivation, altruistic behavior, positive attitude toward outgroups, and positive interpersonal behavior (helpfulness, kindness, consideration) in the classroom. Children in the CDP program also expressed greater sense of personal efficacy, reduced loneliness in school, reduced social anxiety; and reduced marijuana and alcohol use. In addition, they were more academically motivated, had higher academic self-esteem, enjoyed reading more in and out of school, were more actively engaged in class, enjoyed class more, and liked school better. (Developmental Studies Center, 1998, p. 6)

It is notable that in the Hayward study, the relationship between a sense of community and student outcomes was strongest in the poorest schools. Outcomes that held even when poverty was controlled included trust in and respect for teachers, liking for school, enjoyment of helping others learn, inductive reasoning, concern for others, altruistic behavior, conflict resolution skill, and social competence.

3. When schools did not show gains in implementation, comparison students showed greater gains than CDP students. According to the DSC (1998), these results suggest that “poor and/or inconsistent implementation may lead to unintended negative consequences for students—possibly because it produces confusion and insecurity—and therefore may be worse than no implementation at all” (p. 11).
4. No consistent differences were found on program effects on student academic achievement. However, in the intermediate school follow-up in the San Ramon and Hayward studies, but not the six-district study, higher levels of program implementation led to better student performance on standardized achievement tests. In the six-district study, comparisons of achievement test results were problematic

because of different tests used, different grades assessed, and different times of testing. In one district in which a state reform mandate was consistent with CDP, the program schools did show a positive impact on student achievement. Researchers speculate that change in motivation might be required to precede a change in academic performance and that they did not allow enough time for this to occur. They also speculate that teachers may have concentrated on social aspects more than on providing a challenging and engaging academic curriculum.

Results in all three studies show that a caring community affects development of personal and social qualities, academic orientations, and qualities that help students avoid the risk of problematic behaviors such as delinquency, vandalism, drug and alcohol abuse, and alienation and disengagement from school. CDP researchers argue that previous failures of efforts to change these problematic behaviors are due to focus on individual student change rather than on the process of schooling itself.

### Kamii

Constance Kamii has worked since the mid 1970s on arithmetic from preschool through third grade. In the constructivist classrooms she evaluated, the teacher consciously reduces her authority and promotes children's autonomy. Arithmetic is integrated into many activities, including daily routines such as lunch count and attendance, distribution (for example, of snacks), division of objects (such as Halloween candy), the collection of objects (such as permission slips), keeping records (such as how many more books the class needs to read to reach 100), making sure objects are not lost (such as game pieces), voting, games with rules, and activities involving money. A Math Committee regularly solved various problems having meaning to the class (for example counting pennies given for a tool shed for the school's garden). Mental math is also a feature of this approach in which the teacher poses a calculation problem, and children figure out the answers without using paper and pencil.

Kamii (2000) reports the results of a study of first-grade children from a constructivist classroom (most of whom had a constructivist kindergarten experience as well) and children from a nearby school in which arithmetic was taught using a textbook and worksheets. She interviewed children on word problems and computational problems. In the word problem interview children were given a sheet of paper, a pencil, and about 50 counters. They were asked to explain each answer. Problems varied in difficulty from simplest addition to more than simple multiplication. In the computation interview involving sums and

differences, children were given a paper with problems and a ruler used to slide down as each problem was answered. The interviewer noted for each problem the time in seconds required for an answer and noted whether children showed evidence of counting on, counting all, or counting on fingers.

Kamii found that the percentages of the Constructivist group succeeding on all 13 word problems were higher than those of the Textbook group and significantly higher on 11 problems. Analysis of children's explanations showed that the Constructivist group showed better part-whole logic and the logic of repeated addition. On 36 computation problems involving addends or minuends to 10 (where answers had to be given within 3 seconds without counting), the Constructivist group did better on all problems except three on which the two groups did not differ. Children in the Constructivist group had superior knowledge of the logic of commutativity (knowing, for example, not only that  $8 + 2 = 10$  but that  $2 + 8 = 10$ ). Kamii makes the point that when children are taught the algorithm of aligning and adding each column, they are especially apt to give absurd answers showing that they simply add all the numerals separately (for example, they say that  $22 + 7 = 11$ ). None of the Constructivist group gave such answers. In the one problem involving "carrying," the Textbook class that had not been taught to carry (a mechanical algorithm) did better than the Textbook class that received this instruction. This is strong evidence for Kamii's statement that "teaching conventional algorithms as recommended by most textbook series is harmful to children's numerical reasoning" (p. 226).

In Kamii's (1989) book on second grade arithmetic in constructivist classrooms, she describes activities more complex than those described in the book on first-grade. She emphasizes that the goal of constructivist arithmetic is to promote children's ability to invent various ways of solving problems and to judge what answers make sense. Kamii reports the finding that when children are not taught missing addends (such as  $3 + \_ = 5$ ), by second grade, almost all children in a constructivist classroom nevertheless write the correct answers to problems of this type. She accounts for this in terms of children's development of reversible thought. Kamii showed that the second graders in two constructivist classrooms performed at about the same level on the Stanford Achievement Test (SAT) as children (of higher socioeconomic status) who received traditional instruction in two classrooms. However, in tests of children's ability to think, the constructivist children did better than their higher SES peers. For example, in individual interviews, children were shown the numeral 16 and asked to explain what the 1 and 6 meant by

using chips. Almost all (85%) traditionally instructed second graders showed only one chip for the 1 while 67% of the constructivist group showed 10 chips for the 1 in 16. Kamii argues that the SAT measures mostly conventional knowledge (such as how to write one hundred eighteen in numerals and the meaning of the “less than” sign) while her interviews focus on more complex logico-mathematical knowledge. Results of this research show that in comparison with Traditional children, Constructivist children demonstrate significantly better understanding of regrouping, regrouping and place-value combined, estimation problems, mental arithmetic problems (doing problems without paper or pencil within 9 seconds), and story problems. Again, analysis of explanations showed that more children from the Traditional group made errors in reasoning and gave nonsense answers. Kamii concludes that the two groups performed similarly on the SAT because the SAT problems are easy and superficial with a low ceiling. She argues that on the tests with more complex problems, differences consistently favor the Constructivist over the Traditional group.

In her book on third grade arithmetic, Kamii (1994) describes evaluation of 13 third grade children who had experienced constructivist arithmetic in grades 1-3. These children had never been taught any algorithms. The comparison group came from another school that had scores on the SAT consistently much higher than those of the school in which the constructivist class was located. Children were interviewed three times and given a group test of six word problems. Results showed that the Constructivist group reasoned significantly better than the Comparison group in all the word problems and that the incorrect answers of the Comparison group were due mostly to poor logic. Generally, the Comparison group showed poor knowledge of place value. Kamii concludes that “the children who had three years of constructivist arithmetic generally did better than the traditionally instructed children both in logical and in numerical reasoning.

This research is significant because it goes beyond the low-level focus of standardized tests in early childhood to assess the logic of children’s mathematical reasoning as well as correct answers.

#### DeVries

DeVries and her colleagues (DeVries, Haney, & Zan, 1991; DeVries, Reese-Learned, & Morgan, 1991) studied interpersonal understanding in three kindergarten classrooms differing in sociomoral atmosphere and academic program. The Constructivist teacher provided the array of activities described

earlier as typical. The DISTAR teacher provided teacher-directed programmed instruction of small and large groups with recitation and fast-paced drills. The Eclectic teacher provided activities typical of both the other two programs, including some direct instruction and some activities such as art, pretend play, and group games. Data on implementation focused on the sociomoral atmospheres of the classrooms. This was measured by videotaping each classroom teacher (wearing a wireless microphone) for two entire days. Using our adaptation of Selman's (Selman, 1980; Selman & Schultz, 1990) conceptualization of (Enacted) Interpersonal Understanding (with subcategories of Negotiation Strategies and Shared Experience), over 20,000 teachers' interactions with children were microanalytically coded from transcripts and video.

Coding of Negotiation Strategies focused on four levels:

Level 0 (Impulsive): Children are treated as objects. The teacher impulsively overwhelms children physically or psychologically by such actions as grabbing or yelling.

Level 1 (Unilateral): Children are to command or control. The teacher unilaterally expresses his or her wishes to children by such actions as bribing, demanding, directing, threatening, punishing, or rewarding.

Level 2 (Reciprocal): Children are to persuade. The teacher shows consideration of children's needs or wishes and coordinates these with his or her own by such actions as making requests, taking turns, giving a reason for a rule, and invoking logical consequences.

Level 3 (Mutual): Children are to understand and be understood by. The teacher strives for mutual understanding by actions such as helping children recognize various points of view, raising issues of fairness, and encouraging solution of interpersonal problems.

Levels of Shared Experiences reflected positive emotional sharing at four levels parallel to those of negotiation strategies. The degree of sharing may be weak as when one briefly acknowledges the other, or strong as when two laugh together at a shared secret.

Results of this analysis (DeVries, Haney, & Zan, 1991) showed great differences in teachers' interpersonal understanding. The DISTAR teacher's interactions with children were almost all (97%) at Impulsive and Unilateral Levels, with 2.8% at the Reciprocal Level, and .03% at the Mutual Level. The Eclectic teacher's interactions were much like those of the DISTAR teacher, predominantly at the

Unilateral Level (92%), with 5% at the Reciprocal Level, and 0.2% at the Mutual Level. The Constructivist teacher's interactions were only 65% at the Unilateral Level, with 31% at the Reciprocal Level, and 3.7% at the Mutual Level. The conclusion was that the sociomoral atmospheres as assessed by the teachers' interactions with children were very different in the three classrooms.

A study of the Enacted Interpersonal Understanding of the children in these three classrooms reflected these differences in sociomoral atmosphere. Pairs of children (N=56) were videotaped in board game and sticker division situations outside their classrooms, and their interactions were coded according to the same Selman levels. Results showed that a predominance of unilateral interactions characterized all three groups. While impulsive behavior was about the same for all three groups, children from DISTAR and Eclectic classrooms engaged in less reciprocal behavior than did children from the Constructivist classroom. Findings for Shared Experiences were similar, with much less impulsive and more reciprocal behaviors among Constructivist children. These differences among the three groups were all statistically significant.

Considering only interaction segments defined as conflicts, Constructivist children used less impulsive and more reciprocal Negotiation Strategies than children from the other two classrooms. They also used less impulsive and more reciprocal Shared Experience. These differences are statistically significant. A striking finding was that Constructivist children resolved significantly more (70%) of their conflicts than DISTAR (40%) or Eclectic (33%) children.

While this was not a study of children's academic performance, children's performance on the Metropolitan Achievement Test (MAT) and a state-constructed test (TEAMS) was provided by the school district. While the DISTAR group scored significantly higher than Constructivist children did at the end of first grade, by third grade Constructivist and DISTAR children were not significantly different on either test. The effects of all that rote drill and practice faded quickly.

In an earlier study, DeVries and Goncu (1987) used the board-game format to compare interpersonal understanding between 4-year-old children from constructivist and Montessori classrooms. The pattern of findings was similar to those described above. Constructivist children had a significantly higher proportion of Stage 2 strategies and resolved a significantly higher proportion of their conflicts (64% for constructivist pairs and 30% for the Montessori pairs).

### Araujo

Araujo (2000) studied moral autonomy of 56 six-year-old children in three preschool centers. Children from centers A and C were from lower socioeconomic families, and children from center B were from upper middle socioeconomic families. Ethnographic methodology was used to study program implementation. The program of center A was based on Piaget's theory, including mutual respect of children and adults, group activities favoring reciprocity, opportunities to make classroom decisions and choose among alternatives, free expression, and the absence of punishments and rewards. Children in center A experienced a cooperative school environment while those in B and C experienced an authoritarian environment. All went on to traditional authoritarian schools after kindergarten.

Children responded to eight moral dilemmas adapted from Piaget (1932/1965) in 1992 (kindergarten year), 1995, and 1999. The dilemmas reflected five aspects of morality involving children's ideas about (1) punishment, (2) conflicts resulting from retributive and distributive justice, (3) conflict resulting from equality and authority, (4) the intention and material consequences of actions, and (5) their consciousness of rules. Responses were analyzed in terms of three categories: heteronomous, autonomous, and transition answers. Global Individual Scores were assigned. Children who gave at least five heteronomous answers were labeled "heteronomous" (coded 0); children who gave at least five autonomous answers were labeled "growing autonomy" (coded 1); and children not fitting these categories were labeled "transition" (coded .5). A Global Center Score was an arithmetic average of scores of individuals in that center.

Results showed that children from center A (the constructivist center) expressed higher personal autonomy in 1992 and 1995 than children from the authoritarian centers. In 1999, the children from centers A and B tied with an average of 6.0, and both were higher than center C (4.5). He speculates that this finding is due to "values education" in center B during the last two years of the study period. It may also be that many of the children are reaching a ceiling on the dilemmas. It would be interesting to know more about the "values education" in center B.

### Duckworth

The African Primary Science Program grew out of the Elementary Science Study approach developed by the Education Development in Newton, Massachusetts. It took place in Kenya, under the

auspices of the Kenya Institute of Education, and involved children from 5 to 15 years of age in the beginning of the program that extended over three years. The broad goals were similar to those developed later by Kamii and DeVries for physical-knowledge activities. Duckworth (1978) designed an evaluation study based on the assumption that “the important thing in any learning is to be able to use it, to go beyond it, in the direction of further learning and activity” (p. 51). The first evaluation procedure was to study behavior in a situation in which children were introduced to a room with a variety of both familiar and unfamiliar materials. They were told to do whatever they wished, and for the next 35 minutes two observers followed a time-sampling procedure to record what children did. Complexity of thought in children’s activities was categorized as simple, moderate, elaborate, or extraordinary. “Simple” activities included those that were the obvious and easy things to do with a given material (such as picking things up). “Moderate” activities required some determination and went beyond the obvious in any of a number of ways (such as putting objects on the balance in some systematic way). “Elaborate” activities required more planning and/or understanding of the nature of the materials (such as using a mirror to look for an image other than the child). “Extraordinary” activities went beyond these (such as making a “walking” cotton spool by passing a rubber band through the center hole and winding it on bits of stiff grass, strung with string to make a braking mechanism). Diversity was assessed by counting the number of “different” activities.

The second evaluation procedure was to study children’s development of reasoning on tasks involving classification, seriation, and spatial relations.

Using these procedures, Duckworth compared children from the active African Primary Science Program with children from the regular school program who had a traditional text-oriented science program. Her analysis revealed that the classes showing the most complexity and diversity of ideas were classes from the African Primary Science Program. Classes with the fewest ideas and the least initiative were comparison classes from the regular school program. Significantly more children in the active program did work that was at least “elaborate,” and significantly fewer children from these classes did work that was no higher than “simple” in complexity. All work scored as “extraordinary” was done by children from the active African Primary Science Program.

On five of six Piagetian reasoning tasks, randomly selected children from the active program classes scored significantly higher than children from comparison classes. Only on Seriation of Weights were the groups not statistically different. The one class in the active program for the longest time (3 years) did better than classes in the program less time. This research is significant because it showed that children in the active program progress more in the structure of their reasoning as well as in the complexity and diversity of their ideas.

### Golub and Kolen

Duckworth's study was taken as a model for evaluating younger children in kindergartens in four schools in Evanston, Illinois where they attempted to implement the Kamii-DeVries approach (that, in the 1970s consisted of physical-knowledge activities and group games plus child development activities such as art, music, pretend play, blockbuilding, etc.). Piagetian tasks of operational reasoning were rejected as assessments because no matter how good a program virtually all 4- and 5-year-old children are expected to remain preoperational in reasoning. Evaluation at this age must thus focus on other social and cognitive indicator classes (having more teacher-directed activities and less emphasis on peer interaction), matched on race, sex, and socioeconomic status. Children were randomly assigned in three of the schools to either regular or constructivist groups. In the fourth school, all kindergarten children were included in the constructivist program.

In the adaptation of Duckworth's procedure, children (10 at a time from a class) spent 20 minutes in a room with three types of materials placed on tables and rugs: items typically found in kindergarten classrooms (such as scissors, paper, pencils, paper, and blocks), commonplace items not usually associated with school (such as twigs, funnels, seeds, and buttons), and unfamiliar items including some from another culture (such as African musical instruments) and educational materials not commonly available.

Analysis of children's activities showed that mean complexity score of children from the constructivist program was significantly higher than that of children from the regular program. Moderate or extraordinary complexity was found in a significantly higher percentage of constructivist children (35%) than comparison children (27%). Social interaction was significantly greater and more independent of adult guidance among children from the constructivist kindergartens.

### Democratic Versus Authoritarian Teaching Styles

The constructivist programs reviewed above are democratic programs and were compared with authoritarian programs. However, they also included other elements as well. A good deal of research predating constructivist education provides us further information on the effects of the specifically democratic aspect of constructivist education. We review here studies by Lewin, Lippitt, and White, and the Eight-Year Study.

#### Studies by Lewin, Lippitt, and White

The classic research done by Lewin, Lippitt, and White and their students and colleagues at the University of Iowa in the late 1930s and 1940s compared authoritarian, laissez-faire, and democratic leadership styles in lunchtime or after school clubs for 10- and 11-year-old boys (and girls in Lippitt's 1939 study). The clubs generally met for 50 minutes twice a week. In a series of pioneering studies (Lewin & Lippitt, 1938; Lewin, Lippitt, & White, 1939; Lippitt, 1939; Lippitt & White, 1943, 1947), these researchers examined the effects of the three leadership styles. In the authoritarian condition, the experimenter determined all policy, dictated steps in the project one at a time in order to maintain uncertainty in the children, dictated work task and work companions, often disrupted ongoing activity by an order that started a child off in a new direction not spontaneously chosen, and used "personal" praise and criticism of the work of each member. It is especially important to note, however, that the authoritarian leader "was friendly or impersonal rather than openly hostile" and that "no radically autocratic methods (for example, use of threats, instilling fear, etc.) were used" (Lewin, Lippitt, & White, 1939, p. 273, 274). The *laissez-faire* leader provided materials and let the children know that he would provide information if asked. He gave children complete freedom and refrained from participating or interfering in the activities. The democratic leader took into account the children's own goals, submitted all policies to the group for discussion and decision, indicated general steps to the group goal, provided technical advice when needed (offering several alternative procedures from which choice could be made), and was matter-of-fact in praise and criticism. Children were free to choose work partners and were responsible for the division of tasks. (See Lippitt & White, 1943, for transcripts that elaborate this description.)

These studies were characterized by careful methodology in which children were selected so that the groups would be equated on such characteristics as personality, leadership ability, friendship and

rejection relations, intellectual status, physical status, and socioeconomic background. The democratic leader offered children the choice of what to do during their club time (for example, make masks, do soap carving, make things from plaster of paris, paint a mural, construct model airplanes, etc.), and the authoritarian group was assigned the same activity. Observers were visible but placed behind a low burlap wall in a dark corner of the room where they recorded the group's behavior, including a running account of interactions and conversations; minute-by-minute sub-groupings, activity goals, and ratings of degree of unity of subgroups; and films of segments of club life. Each child was interviewed during the transition from one style to another, parents were interviewed about their discipline strategies, and teachers were interviewed. In addition, conversations with children during two summer hikes took place after one experiment was over.

In the first experiment, the same leader (Lippitt) organized two groups of five 10-year-olds in mask-making clubs that lasted three months. He led one club in an authoritarian manner and the other in a democratic manner. In this study, the authoritarian club members developed a pattern of aggressive domination toward one another, but were submissive or persistently demanding of attention from the leader. Interactions in the democratic club were more spontaneous, fact-minded, and friendly. Relations with the leader were "free and on an 'equality basis'" (Lewin, Lippitt, & White, 1939, p. 277). Aggression in the authoritarian group was 40 times more frequent than in the democratic group. Twice during authoritarian club meetings, aggression of the group focused on one member. In both cases, the scapegoat left the group. Ego-involved language behaviors (for example, hostility, resistance, competition) occurred 73 per cent of the time in the authoritarian group and 31 per cent of the time in the democratic club. In the second five-month experiment, each of four groups of 11-year-olds was led for six weeks by each of the three kinds of adult leaders described above. Each group was thus compared with itself. Having each of four leaders enact more than one leadership style controlled the personality of the adult leader. Quantitative study of the implementation of the leadership styles showed that leaders did differ significantly in their enactment of the styles according to their definitions (Lippitt & White, 1943). Group differences were thus not due to the personality of the leader but to leadership techniques. Lippitt and White (1943) note that in at least two of the submissive autocracies, "the boys apparently 'gave up,' to a large extent, their normal wish

for autonomy, independence, or self-determination” (p. 501). Children in the autocracies manifested highly inhibited sociability.

Results showed that groups changed markedly when the leadership changed to a new type under a different leader. Findings revealed that authoritarian leadership sometimes led to more “submissive, highly dependent, socially apathetic” behavior and sometimes to more “aggressive, irritable, self-centered” behavior (and sometimes to scapegoating) than with democratic leadership (Lippitt & White, 1943, p. 491). *Laissez-faire* groups generally engaged in more aggression than the other two groups. Cycles of boredom and outbursts of horseplay were observed. Moderate levels of aggression were found for democratic leadership. Outbursts of aggression occurred dramatically on the day of transition from autocratic to *laissez-faire* or democratic atmospheres, especially when the autocratic group had been apathetic and submissive to the autocratic leader.

Children’s serious work during the absence of the leader dropped in submissive autocracies from 74% with the leader present to 29% with the leader absent. “Distracted work atmosphere” in this group increased from 6 to 20% while the leader was absent. In aggressive autocracies, serious work dropped from 52% with the leader present to 16% with the leader absent. In democratic clubs, a serious work atmosphere shifted negligibly from 50% to 46%. For the *laissez-faire* clubs, a similar lack of effect was found when the leader was absent.

In the aggressive authoritarian groups, a “strike” and rebellious actions occurred. Scapegoat attack and reciprocal aggression among all members also occurred in the aggressive autocracies. Increase in aggression when the leader left and during transition to freer atmospheres occurred in the apathetic autocracies.

At the end of the first experiment, children in the authoritarian group voted by secret ballot to discontinue their meetings. When the leader announced the end of the club, children ran around in a wild manner. When given the masks they made, the children threw them down on the floor in a destructive manner. In contrast, the democratic club presented one mask to their classroom teacher and took the others home as room decorations.

In interviews, boys expressed dislike of the autocratic leader and greater liking for the democratic leader. Most liked the *laissez-faire* leader better than the autocratic leader. Group cohesion, friendly

remarks expressed to the leader, the use of the pronoun “we” as opposed to “I,” organized play, and group-minded remarks to the leader and to group members were all much higher in the democratic clubs. Expressions of discontent were highest in the aggressive autocracies, and disorganized play was highest in the *laissez-faire* clubs. Conversation analysis revealed a high proportion of dependent reaction to the leader in autocracies as contrasted with democracies. Lippitt and White (1943) conclude that the morale was much higher in democratic clubs than in the others. More ego-centered competitive behavior occurred in authoritarian groups than in democratic groups, and in authoritarian groups, the children were less inclined to praise each other’s work than in democratic groups. Cooperation efforts more easily emerged in democratic clubs.

#### The Eight-Year Study

The Eight-Year Study was undertaken in 1933 by a Commission of the Progressive Education Association to study the relation between the type of high school program and success in college. In order to free high schools from rigid requirements by colleges and universities and allow them to develop progressive curricula, the Commission gained an agreement from almost all (about 300) accredited colleges and universities to accept graduates (recommended by their principals) from 30 experimental schools (including Des Moines High School and Junior High School) for a period of 5 years, starting in 1936. These 30 schools, some progressive, some conservative, had the freedom to reconstruct their curricula on the basis of individual needs without regard for college entrance units or entrance examinations. The principal would submit a complete record of the student’s academic and extracurricular activities and interests, and scores on scholastic aptitude, achievement, and other diagnostic tests given by the school.

The member schools proposed that they furnish the colleges with pertinent information in lieu of the usual units and examination data. The noted Ralph Tyler established an Evaluation Staff and worked to help each school to evaluate its work in relation to its own goals. This led to the need for curriculum revision, and a Curriculum Staff was employed. The basic question was “whether the work of these schools which most of us would classify as progressive schools, and the character of the teaching and general experience in these schools, fits or misfits students for college work” (Aikin, 1942, p. 148).

The schools agreed that their educational programs must “*meet the needs of adolescents and seek to preserve and extend democracy as a way of life*” (Giles, McCutchen, & Zechiel, 1942, p. 5). Regarded as

paramount was the democratic value of “regard for the integrity and worth of each individual” (Giles, McCutchen, & Zeichel, 1942, p. 9). John Dewey was an important influence on the curricula of the Eight-Year Study. Classroom procedures included providing students with many opportunities to deal with problems they consider significant, utilizing wide sources of information, sharing responsibility for defining the problem; formulating hypotheses; collecting, organizing, and interpreting data; evaluating growth in terms of these responsibilities; and seeking meaningful, real situations in which students may engage in reflective thinking.

Schools in the study had complete autonomy with regard to their objectives, curricular organization, subject matter, and administration. Wide variations thus occurred. Every school and its staff struggled with issues such as to what extent the curriculum should be based on needs of students and to what extent it should be based on subject-matter content, and to what extent planning should be done in consultation with students. A general issue was whether students could be prepared for life in a democracy by authoritarian methods. Schools in the study shifted from studying subject matter as an end in itself to studying problems that most concern adolescents. According to Giles, McCutchen, and Zeichel (1942), “The role of the teacher has changed from guide of a conducted tour to guide of a group of explorers” (p. 130). Subject matter was viewed as a means to an end and not an end in itself. Democratic practices were elaborated that allowed student choice and participation in planning and evaluating what he or she would do.

A characteristic of democratic schools was that students worked with teachers in a co-operative relationship. According to Aikin (1942), “Pupils join with the teacher in deciding what goals are to be sought, in selecting the steps to be taken to reach the desired ends, and in setting up tests or measures to find out whether objectives have been reached” (p. 43). Students shared in many different activities, including managing dining halls, and, in some schools students worked with teachers in trying to find solutions to the most difficult sorts of problems. The ideal of democratic schools was that students work for purposes they think important, not for teachers or grades.

The Evaluation Staff worked co-operatively with schools to devise tests that reflected the purposes of the school. These purposes included effective methods of thinking, cultivation of useful work habits and study skills, inculcation of social attitudes, acquisition of a wide range of significant interests, development

of increased appreciation of music, art, literature, and other aesthetic experiences, development of social sensitivity, development of better personal-social adjustment, acquisition of important information, development of physical health, and the development of a consistent philosophy of life (Aiken, 1942). The Evaluation Committee developed about 200 tests that aimed at the evaluation of these objectives. For example, to give a flavor of the thoroughness of the study, a test of the “Application of Certain Principles of Logic” provided exercises that “require the student to determine what conclusions follow logically from the premises” (Aikin, 1942, p. 91). The general approach is illustrated by the division of intellectual competence into scholarship, intellectual curiosity and drive, scientific approach, and study skills and habits. Sources of evidence pertaining to intellectual curiosity and drive included questionnaires, reading records, interviews, samples of written work, and reports from instructors.

The question addressed by the Evaluation Committee was: Did they succeed in college? (Chamberlin, Chamberlin, Drought, & Scott, 1942). To answer this question, they studied 1,475 pairs of students matched on scholastic aptitude scores, sex, race, age, religious affiliation, size and type of secondary school, public or private education; size, type, and geographic location of home community; the socio-economic status of family; extra-curriculum activity in secondary schools; vocational objectives; and other factors available from admission data. Those who entered college in 1936 were studied for four years, those entering in 1937 for three years; those entering in 1938 for two years; and those entering in 1939 were studied for only one year. Data were gathered from interviews with students, questionnaires, records of reading and activities, reports from instructors, official college records, and comments of college officers, house heads, and others who had contact with the students. Some of the overall findings were that the graduates of the Thirty Schools, in comparison to matched comparisons, earned a slightly higher total grade average; earned higher grade averages in all subject fields except foreign language; were more often judged to possess a high degree of intellectual curiosity and drive; were more often judged to be precise, systematic, and objective in their thinking; more often demonstrated a high degree of resourcefulness in meeting new situations; had about the same problems of adjustment as the comparison group, but approached their solution with greater effectiveness, earned in each college year a higher percentage of non-academic honors (for example, officership in organizations), and demonstrated a more active concern for what was going on in the world (Chamberlin, Chamberlin, Drought, & Scott, 1942; Aikin, 1942).

Students from the six participating schools considered to have succeeded the best in creating the “most marked departures from conventional college preparatory courses” and students from schools in which the “least change had taken place” were compared in relation to their matched groups (Aikin, 1942, p. 112). The authors state the results as follows.

The graduates of the most experimental schools were strikingly more successful than their matchees. Differences in their favor were much greater than the differences between the total Thirty Schools and their comparison group. Conversely, there were no large or consistent differences between the least experimental graduates and their comparison group. (Aiken, 1942, p. 12)

Finally, a study was made of the graduates of two schools, which were among the most progressive. Again, these students were contrasted with their matchees. The superiority of these progressive graduates over their comparison group was greater than any previous differences reported. The authors concluded:

Clearly, among the Thirty Schools, the more experimental the school, the greater the degree of success in college. Furthermore, although students of high aptitude seem to have profited most from experimental education, students of low aptitude profited as much from experimental programs as their matchees did from conventional schooling. (Chamberlin, Chamberlin, Drought, & Scott, 1942, p. 209)

#### Practical Implications for Schools

I would like to address administrators, school board members, and teachers who may be interested in undertaking the implementation of a constructivist approach by underscoring the critical importance of good implementation. Various studies showed that the better the constructivist implementation, the better the child outcomes. Further, with poor implementation, outcomes were worse or no better than traditional comparisons. This suggests that schools should not undertake a constructivist program without the seriousness of purpose and dedication necessary to achieve the good implementation that produces good child outcomes.

Constructivist education is not easy to implement. While it can be characterized in terms of certain types of activities, the activities do not assure implementation of the program. As noted above, the first principle of constructivist education is to create a sociomoral atmosphere of mutual respect that is continually practiced. Understanding what this means for both academics, classroom discipline, and all other aspects of practice requires a studious and reflective teacher who develops a commitment to a process of change that usually takes at least two or three years. Truthfully, constructivist teachers, including this writer, are continually evolving. Becoming a constructivist teacher or administrator is aided enormously by a support group of like-minded professionals who meet and communicate in a variety of ways about their successes and difficulties.

Addressing researchers and administrators who want research to inform their work brings me to revisit the issue of implementation in a different way. I would like to echo Tuthill and Ashton (1983) who extend Kuhn's (1970) conception of scientific paradigms in the natural sciences to education. They point out that almost all classrooms are "conglomerates of contradictory elements" and that teachers "eclectically apply teaching strategies derived from conflicting scientific paradigms, using a little behaviorism here and a little humanism there, for example" (p. 10). Tuthill and Ashton argue that "such eclecticism significantly reduces the likelihood that researchers will be able to make sense of research results obtained in such classrooms" (p. 10). They call for conscious development and study of "pure prototypes" that avoid the usual eclecticism, in order to evaluate the practical effects of educational paradigms. This raises the issue of what we can conclude from educational research in which the program implementation is not measured and identified. If classrooms are eclectic, what can administrators conclude about the cause-effect links in the education they are offering children? Research on constructivist classrooms where the prototype is validated by measurement of program implementation tells us that this educational approach produces better child outcomes than traditional or non-constructivist programs. Serious consideration of constructivist programs for children seems warranted.

### Conclusion

This paper has focused on a general characterization of constructivist education and results of research on this educational paradigm. It is clear that children from constructivist programs with good

implementations do better on almost all assessments of academic achievement and personal, social, and moral development.

## READINGS ON CONSTRUCTIVIST EDUCATION

### An Annotated Bibliography

DeVries, R. & Zan, B. (1994). Moral classrooms, moral children: Creating a constructivist atmosphere in early education. New York: Teachers College Press.

This is a very “user-friendly” book, and a good introduction to constructivist education. It describes in clear, readable language the sociomoral atmosphere that permeates all aspects of the classroom. Theory is presented, but given a light touch. The bulk of the book consists of practical guidelines and principles of teaching covering all aspects of the class day, including group time, activity time, clean up time, lunch time, and nap time. Chapter also deals with conflict resolution, rule making and decision-making, voting, discipline, moral discussions, and academics.

DeVries, R., Zan, B., Hildebrandt, C., Edmiaston, R., & Sales, C. (2002). Developing constructivist early childhood curriculum: Practical principles and activities. New York: Teachers College Press.

This book outlines four different interpretations of “play-oriented curriculum” in early education. Constructivist education is defined, and general principles of teaching are discussed, along with the important role of assessment and documentation. Physical-knowledge activities and group games are overviewed. In six chapters on casting shadows, exploring the art and science of musical sound, cooking transformation, experimenting with draining and movement of water in tubes, developing geometric reasoning using pattern blocks, using group games to teach mathematics, and variations on a checkers theme, the authors describe how teachers transform activities, intervention, and how children transform their reasoning and knowledge of specific subject matter over the course of a semester.

Kamii, C. & DeVries, R. (1978/1993). Physical knowledge in preschool education: Implications of Piaget’s theory. New York: Teachers College Press.

This (very easy to read) basic text explains physical knowledge activities – what they are and why they are included in the constructivist curriculum – and gives detailed descriptions of five specific p-k activities (rollers, target ball, pendulum, inclines, and water).

Kamii, C. & DeVries, R. (1980). Group games in early education: Implications of Piaget’s theory. Washington, DC: National Association for the Education of Young Children.

This basic text explains the theory and rationale behind using group games in the classroom. It includes principles of teaching and criteria for good group games as well as descriptions of numerous group games. One chapter deals specifically with the issue of competition, what it means and how to deal with it.

DeVries, R. & Kohlberg, L. (1987/1990). Constructivist education: Overview and comparison with other programs. Washington, DC: National Association for the Education of Young Children.

This book is a comprehensive examination of constructivist education. Parts of it are quite theoretical. It is not an “easy read,” but it is well worth the effort if you want to understand constructivist education from the inside out. Besides a thorough treatment of the theory underlying constructivist education, other chapters outline the constructivist curriculum (group games, physical knowledge, moral discussions, number and arithmetic, and reading and writing) and compare constructivist education to other Piagetian approaches, Bank Street, and Montessori (with a focus on both theory and practice).

Duckworth, E. (1987). "The having of wonderful ideas" and other essays on teaching and learning. New York: Teachers College Press.

This is a delightful little book dealing mainly with science education (and some math). Eleanor Duckworth has a gift for being able to get teachers to experience what it is like to think as a child. The first chapter in particular is a joy to read.

Duckworth, E., Easley, J., Hawkins, D., & Henriques, A. (1990). Science education: A minds-on approach for the elementary years. Hillsdale, NJ: L. Erlbaum.

More from Eleanor Duckworth and friends on science education. The subtitle emphasizes that it is not enough for science to be "hands-on," that it must engage the mind as well.

Kamii, C. (1982). Number in preschool and kindergarten. Washington, DC: National Association for the Education of Young Children.

Kamii, C. (1985). Young children reinvent arithmetic: Implications of Piaget's theory. New York: Teachers College Press.

Kamii, C. (1989). Young children continue to reinvent arithmetic: Second grade. New York: Teachers College Press.

Kamii, C. (1993). Young children continue to reinvent arithmetic: Third grade. New York: Teachers College Press.

These four books by Connie Kamii (including three which comprise a series) describe her constructivist approach to math. They contain both theory and practice and include many ideas for math games and activities. We heartily recommend them as valuable additions to any teacher's resource library.

Murphy, D. & Goffin, S. (Eds.) (1992). Understanding the possibilities: Project Construct: curriculum guide. Columbia, MO: Missouri Department of Elementary and Secondary Education.

This edited book describes the effort to implement constructivist education in Missouri. Authors, including teachers, write about issues they have confronted in implementing constructivist education in public schools.

Piaget, J. (1932/1965). The moral judgment of the child. London: Free Press.

For constructivist educators, this is probably the single most influential book Piaget wrote. It is difficult to read, but very rewarding to those who put in the considerable effort that it takes to wade through Piaget's sometimes obtuse writing.

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