Instructional strategies to facilitate the learning of field-dependent children

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Abstract:
Three instructional strategies were examined to assist field-dependent children to compensate for cognitive limitations in memory storage capacity and system flexibility. The interpretive study was conducted with field-dependent (FD) 7-year-old children within an analytical movement education curriculum taught by a field-independent (FI) teacher. Research questions examined (a) the extent to which the strategies increased the learning behaviors of FD children and (b) the perceptions of the FD children when learning using the strategies. Children were tested using the Children's Embedded Figures Test to determine their cognitive styles. Observations and interviews were collected over a four-month period. Emergent themes were analyzed using constant comparison. Results indicated that the Explicit Organization strategy facilitated the memory organization and storage of FD children. The Variable Format and the Student Pairing strategies appeared to contribute to active learning by enhancing the interest and motivation of FD children. FD children were more involved in the tasks increasing their ability to focus mental energy necessary for system flexibility. Discussion centered on the FD children's modification of the Student Pairing strategy to decrease demands on memory storage capacity and preclude the development of memory access strategies.
Key words: Field dependence/independence, memory, 2nd grade, movement education

Article:

Differences in the performances of FI and FD children appear to be related to variations in information processing associated with working memory storage capacity (short-term memory), system flexibility when retrieving previously stored information, and mental energy needed to integrate new information with prior knowledge. For school children, these distinctions may be demonstrated as learning differences in reading comprehension (Davis, 1987), knowledge acquisition (Frank, 1983), communication (Frank & Davis, 1982), sentence verification (Cochran & Davis, 1987), concept formation (Ohnmacht, 1966), perception of musical tempo (Schmidt & Lewis, 1987), and motor skill acquisition (Swinnen, Vandenberghe, & Van Assche, 1986; Todor & Lazarus, 1982).

Educational researchers (Cohen, 1968; Kagan & Zahn, 1973; Saracho, 1989) argued that American schools are structured as analytical or field-independent environments. These environments appear to predetermine the success of children who are adept at learning through conceptual tasks. Problem solving and critical thinking tasks that require children to consider several concepts simultaneously, generate alternative solutions to complex problems, and integrate knowledge from multiple sources may reinforce the learning of FI children while inadvertently excluding FD children (Hale, 1981). Curricula that encourage children to work independently on problem analysis, concentrate for extended periods on detailed tasks, or organize conceptual knowledge as abstract constructs may lead to additional problems for FD children. Saracho and Spodek (1981) reported that FD children also demonstrated learning problems in classes taught with FI teachers. FD and FI teachers were found to create unique learning environments with different levels of expectations for FD and FI children. Cohen (1969) reported that FD students required to learn in highly analytical school environments frequently demonstrated behaviors perceived by teachers as disruptive, nonconforming, or unintelligent. Learning problems were compounded when FD children were encouraged to work alone on abstract problems

that were difficult to conceptualize. Cohen (1968) emphasized that FD children progressively found field-independent curricula meaningless and unrelated to the valued aspects of their lives.

Within elementary movement education in the United States, the curriculum designed by Logsdon and colleagues (1984) has been both praised and criticized for its focus on the conceptual analysis *of* the movement process. In this curriculum young children are encouraged to analyze fundamental movement skills in maturationally-appropriate ways. Aspects of many lessons are devoted to the development of discrete thinking skills (Ennis, in press). Children examine key aspects of locomotor, non-locomotor, and manipulative movement patterns and work to integrate their knowledge into increasingly more skillful performances. The analytical focus of the Logsdon curriculum appears to be more compatible with the preferred cognitive styles of FI children (Ennis & Chepyator-Thomson, 1991). The emphasis on movement analysis, integration of movement information, and autonomous working environments seems best suited for FI children.

This research examined the use of three instructional strategies to facilitate field-dependent children's ability to store and retrieve knowledge, to identify alternate strategies, and to apply their mental energy to integrate new content with prior knowledge. The interpretive study was conducted with four classes of second grade students taught by an expert movement educator using the Logsdon curriculum. The research questions examined *(a)* the extent to which the instructional strategies increased the learning behaviors of FD children and (b) the perceptions of FD children when learning using these strategies. The paper represents the third report in a larger study in which the learning behaviors of FD children were examined interpretively within the Logsdon curriculum (Ennis & Chepyator-Thomson, 1991) and the performance of the same FI and FD children were investigated experimentally using a specific ball interception task consistent with the content of the Logsdon curriculum (Ennis & Lazarus, 1991).

Instructional Adaptations for Cognitive Style

Theoretical explanations for differences in cognitive style have been postulated within both information processing and organismic structure theory. A review of the assumptions of each perspective have been discussed in a companion paper (Ennis & Lazarus, in press). Briefly, cognitive scientists working from an information processing paradigm assert that the working memory capacity of FD individuals is smaller than that of FIs and more rigid. Not only do FD children experience more difficulty holding information in memory, but once a strategy is learned, it tends to dominate, thus inhibiting the development of alternate strategies that may be more appropriate in context-specific situations. Frank (1983) argued that rigidity in thought processes extends to the storage and retrieval processes associated with knowledge utilization. Unless the retrieval cue is presented in a manner consistent with that originally used to encode and store the knowledge, it will be more difficult for FD children to retrieve and apply it in the present situation. This difficulty is associated with the FD individual's inability to utilize alternate pathways to gain access to previously stored knowledge (Davis & Cochran, 1989).

Frank's (1983) research indicated that FD individuals are often confused by the presence of retrieval cues that do not replicate the initial storage cue. In other words, educators who phrase explanations or questions differently over several days of classroom instruction on a topic, may be inadvertently contributing to the confusion of FD children operating from rigid storage and retrieval systems. Goodenough (1976) noted that the FD approach to learning is predominately passive in nature. Passive learners resort to trial and error strategies and overlearning of content rather than comprehension of processes and relationships. Conversely, FI learners appear to embrace the search for alternative associated pathways. They possess flexible retrieval systems that increase the possibility of a positive match between the retrieval cue and the stored information (Tulving & Osler, 1968). They are also active learners (Shuell, 1986) who are intrinsically challenged to search for alternative solutions with changing contexts such as those frequently found in elementary school settings. They are quickly able to reformulate the given cues to address teacher questions or solve novel problems.

The Theory of Constructive Operators proposed by Pascual-Leone (1970) provides additional insight into individual differences in learning and performance attributed to cognitive style. In this theory two psychological

systems described as subjective and scheme-boosting-systems interact to integrate information from the environment with the individual's internal cognitive processes. Scheme boosters either increase or decrease a particular scheme's opportunity for activation. Within this process, low-level schemes associated with content learning may be activated by input from the environment itself. As more schemes are activated they are boosted into larger superschemes that facilitate efficient or automatic levels of performance. These superschemes are abstracted and stored as either overlearned processes or as structural learning boosted by mental energy (Pascual-Leone, 1974).

Overlearned structures result from repeated coactivation of low-level schemes until they become locked in a rigid structural chunk. Structural learning boosted by mental energy, on the other hand, acts within flexible programs that can select and integrate appropriate schemes to meet special task demands. These programs are monitored by sophisticated problem-solving routines termed executive schemes. Mental energy in the form of attention and concentration are required to boost task relevant schemes into superschemes. Within this theory, FD children appear to be dominated by inflexible overlearned structures and may be unable to boost appropriate schemes into superschemes, FD children may experience negative learning experiences as a result of overlearning content rather than processes and relationships. They appear to use low mental energy processors and thus tend not to use the maximum available mental capacity. They are also more likely to exhibit a rigid performance, resulting in the maintenance and continued overlearning of poor strategies, even when they prove continually unsuccessful (Pascual-Leone & Goodman, 1979).

Teachers should be encouraged to use instructional strategies that address specific learning problems of FD children. They should attempt to focus the child's attention on content and learning processes in ways that are most applicable to a wide range of contexts (Kagan, 1987). FD children should be challenged to apply their mental energy to pertinent problems boosting low-level schemes to a level where they may be applied effectively in problem solving. Further, teachers should endeavor to involve FD children as active learners in tasks that are organized to provide social involvement (i.e., Witkin, 1978) within appropriately challenging environments.

Additional criteria for the selection of particular instructional strategies were based on the findings of instructional design (i.e., Van Patten, Chao, & Reigeluth, 1986) and teacher effectiveness research (i.e., Rosenshine, 1979). The strategies selected for examination in this study were first recognized as effective for the instruction of all young children regardless of cognitive style. However, based on the emerging research on memory storage capacity, system flexibility, and mental energy capacity associated with cognitive style, it is believed that several of these strategies may be particularly important for FD children when learning within an analytical curriculum. Based on these criteria, the strategies of *Explicit Organization, Variable Formats,* and *Cognitive Style Pairing* were selected for examination in this study.

Explicit Organization. Results of previous research with FD children in reading comprehension (Frank & Davis, 1982), concept formation (Ohnmacht, 1966), movement education (Ennis & Chepyator-Thomson, 1991), and motor task performance (Ennis & Lazarus, in press) suggested that FD children experience learning problems when the focus of the lesson was on abstract concepts involving mental imagery. Abstract concepts and mental imagery are thought to require additional amounts of memory storage space and mental energy to process, store, and retrieve this information. The explicit organization strategy elaborated and applied the work of Ausubel and others on advance organizers (Allen, 1970; Ausubel, 1960; Satterly & Telfer, 1979). Advance organizers were designed originally to make the underlying structure of written text material more explicit. Advance organizers are attention-attracting statements that focus the learner's attention on the central concepts or unifying principles within a written document. Because children rarely use textbooks in movement education classes, Ausubel's advance organizer strategy was modified to involve primarily verbal, pictorial, and demonstration material. In the modification, termed the Explicit Organization strategy, the teacher reiterates one or two key elements throughout the introduction, demonstration, and practice sections of the movement lesson. More than simply stating objectives, this procedure uses several types of organizers to focus FD children's attention on aspects of the lesson essential to success. Explicit Organizers in the form of teacher questions and

the repetitive use of terms, phrases, and pictures are utilized both to emphasize major concepts in the discussion and to remind children of the order of tasks to be performed.

Variable Formats. Shuell (1986) noted that passive learners often remain uninvolved in the lesson and are easily distracted from the academic task. FD children when working in a passive mode do not perceive the relevance of abstract ideas and frequently do not work to boost schemes into superschemes. The Variable Format strategies (Boykin, 1982; Katz, 1967; Vasquez, 1988) are useful in increasing the involvement of the FD child in class activities. Boykin (1982) reported that many children disassociate themselves from sterile presentations that are perceived as boring. They often seek other avenues for achievement and expression. A variety of different task structures from simple to complex and concrete to abstract can be included in each class session (Van Patten, Chao, & Reigeluth, 1986). In addition, affective stimulation with an emphasis on involving the child emotionally in the lesson seems to enhance the child's interest and motivation in the educational setting. For example, the beginning discussion within the lesson can be modified to involve a series of short segments that cover the traditional curricular topics. Each segment is punctuated by attention-focusing demonstrations, frequently with the FD child as the center of the demonstration. The order and the format of the discussions are varied often to provide students with an interesting and stimulating environment. Efforts to involve FD children directly in the introduction, demonstration, and practice components of the *lesson* are encouraged.

Student Pairing. The third strategy combines the analytical strengths of the FI children with the social preferences and abilities frequently associated with FD children (Witkin, Moore, Goodenough, & Cox, 1977). Research with FD children has often focused on personality components reflected as preferences for social interaction. FD children seemed to prefer to learn and play in social settings, while FI's worked effectively in autonomous environments (Saracho, 1989). Witkin (1978) explained FD individuals' preferences for social interactions as an effort to acquire information regarding structure from more FI individuals. Goodenough (1976) pointed out that FD individuals are responsive to external or social reinforcement. They respond most effectively to encouragement and behavior modification from peers and significant others such as the teacher rather than relying on internal cues or comparisons with criteria. The Student Pairing strategy examined in this study reflected the research on cooperative learning (Johnson & Johnson, 1983; Johnson, Johnson, & Maruyama, 1983) and attempted to place FD and Fl students in symbiotic relationships. When using this strategy several tasks are designed within the lesson to be completed by the students in field-dependent / independent pairs. Student Pairing encourages each child to contribute to the learning process. Students are evaluated based on both their individual role within the pair and the overall outcome of their cooperative effort.

These three instructional strategies were selected for this research because they represented effective instruction (i.e., Gage, 1976; Rosenshine, 1979) and appeared to be consistent with the memory capacity, organization, and mental energy constraints associated with the learning of FD children. Interpretive research methods were used over a 4-month period to observe the performance of the teacher and FD children within four classes taught using these strategies. Interviews were conducted with the teacher and FD children following the observation period to examine attitudes of participants regarding the effectiveness of the strategies.

METHOD

Subjects

Children (n = 96) in one teacher's four second-grade physical education classes taught using a movement education approach (Logsdon *et al.,* 1984) were tested using the Children's Embedded Figures Test (CEFT) to identify their cognitive style (Witkin, Oltman, Raskin, & Karp, 1971). The subjects were part of a sample of second grade children (N = 254) who were tested within a larger study (Ennis & Chepyator-Thomson, 1991; Ennis & Lazarus, in press). The CEFT consists of two timed sections in which students locate and trace a simple figure, such as a triangle, hidden within increasingly more complex drawings. Scores range from:0-24 with one point awarded for each figure traced. At the time of testing, the average age of the children was 7 years 4 months. Students in these classes were 52% female. CEFT scores for this sample ranged from 1-24. Students whose scores fell in the first quartile (n = 24; scores > 17) were identified as FI while those in the fourth quartile

(n -= 24; scores < 8) were categorized as FD. Children in the FI group were 54% male with an average age of 7 years 4 months. Children in the FD group were 58% female with an average age of 7 years 3 months.

The teacher, Pamela, was selected based on her experience and expertise in teaching using the movement education curriculum. She was 37 years of age and had been teaching young children using the approach for 15 years. She had completed as master's degree and had participated in numerous staff development sessions using the Logsdon approach. Pamela was frequently involved in mentoring student teachers and had received outstanding teaching awards from both her school district and the local University. During the previous term she had participated with 24 other school district staff members in 7 sessions to enhance her ability to teach using the instructional strategies described above. She received the highest total score from supervisors for her abilities to teach using these strategies. Pamela scored 17 out of 18 on the Group Embedded Figures Test (Witkin, Oltman, Raskin, & Karp, 1971) during the staff development session and was categorized as field-independent.

Data Collection

Interpretive data were collected by the investigator using field note observation and interview methods (Goetz & LeCompte; 1984, Howe & Eisenhart, 1990). The investigator collected field note data through non-participant observations twice each week during a four-month period (Patton, 1980). Field note observations focused on the extent to which both FI and FD children demonstrated learning behaviors consistent with the teacher's expectations. Observation data also recorded the quantity and the nature of the children's interactions with classmates and the teacher. The teacher kept a journal to record her personal insights over the four-month observation period. Pamela's primary emphasis was on the extent to which the FD children's behaviors changed as a result of the strategies. The major focus of this article is the performance of the FD children, although descriptive data from the FI children is included when it enhanced the understanding of the FD children's performance.

Following the observation period, formal interviews were conducted with the teacher and a sample of 20 children. All of the interviews followed a formal, structured open-ended format (Spradley, 1979). Pamela was interviewed for 60 minutes at the conclusion of the observation period. Children were selected in a random sample stratified by cognitive style and gender. Children were interviewed individually. Interviews lasted l 5 minutes and focused on the children's feelings about participating in the classes taught with the strategies. Interviews were taped and transcribed for analysis.

Data Analysis

Data were analyzed using *constant comparison* (Glaser & Strauss, 1967) to examine properties and themes within the data. Constant comparison is an inductive process that occurs in approximately three phases. In the first phase, incidents from the observation data collected in this study were compared with data reported in the teacher's journal and teacher and student interviews to identify categories for further analysis. As categories emerged, related properties were recorded and used as the parameters for category membership. The data were then rescanned using the emerging themes and properties as the basis for analysis. Every example that might be construed as contributing to or inhibiting the learning environment for FD children was included in the initial analysis. In the second phase, category integration, themes and concepts that emerged from the journal and observations were triangulated with the children's impressions of their experiences to describe the learning environment. Examples that did not readily fall into categories or were contradictory to the emerging themes were held separately for later analysis. In the third phase, properties or essential characteristics were compared or triangulated across categories to test for the integrity of category membership, thus delimiting the emerging theory. In this way, data from different perspectives were triangulated to examine the quality of the learning environment for FD children.

RESULTS AND DISCUSSION

Analysis of journal, observation, and interview data suggested that the structural redesign of the learning environment served to focus the FD children on the content through enhanced memory organization and

storage. The use of Variable Formats and Student Pairing increased the children's interest in the content and created a willingness to focus mental energy on the task, contributing to active learning.

Strategies Contributing to Memory Organization and Storage

Because the working memory and memory retrieval systems of FD children appear to be smaller and less efficient than those of FI (Frank, 1983), efforts to enhance memory space utilization are paramount to increased learning. The Explicit Organization strategy was selected because it addressed learning processes associated with knowledge storage and retrieval. In this study the teacher, Pamela, modified the environment from one that emphasized abstract analysis of movement concepts often found in the Logsdon framework, to one that explicitly assisted FD children to recognize, organize, and store relevant content. Field note observations of the class over the four-month period indicated that Pamela limited her presentations during the introductory phase of the class to one major concept that she wanted all children to remember. This concept was stated clearly during the introduction lesson and refined and elaborated throughout the unit. She developed posters and cards as Explicit Organizers to remind children of the appropriate performance and reinforced the major concepts consistently throughout the lessons. Further she used questioning as an explicit organizer to assist the FD children to focus on the major concept and to emphasize the concept's importance in the introduction and practice sessions.

Journal entries during the early weeks of the study suggested that Pamela was working conscientiously to identify the critical concepts of each lesson and present them clearly and concretely as Explicit Organizers for the FD children:

> I am beginning to think about the balance concept that I want to present to the class next week. In the past I have taught this concept with a variety of examples and nonexamples and allowed the children to learn intuitively what it means to be balanced. But I have always worried that some of them were not focusing on the critical concepts of balance (the relationship between center of gravity and base of support) that I feel is essential to an understanding of the balance concept.
>
> Next week I think I will begin with the various balancing activities — like before, but I will stop the class frequently to ask questions about what is happening when we are balanced and when we lose our balance. I will point out during the first few activities the difference between a narrow and a wide base of support. During the next few classes I will develop the principles of balance associated with centering your weight over your base of support. I will still talk about it as balancing your "top" over your "base", as I have done in previous years, but again I will make sure that all children — especially my FD children — are focusing on this central concept.

Pamela stated in the final interview that she "did not have to spend as much time redirecting students back to the task. It was as though they knew for the first time what the sequence was supposed to look like." FD children reported in their interviews that the teacher's use of the Explicit Organizers helped them to remember the instructions: "When she says it three times, you have to remember!" (Male). Other comments from FD children suggested that they noticed the Explicit Organizing strategies and appeared to respond positively:

> Sometimes she (teacher) asks you a question and you don't know the answer. She tells you what to think about and helps you keep working until you get the answer (Female).
>
> 1 like the (task) cards at the jump rope station. They remind you of all the different ways that you can do it (jump) (Female).

The observation data suggested that the most critical aspect of memory storage for these children was the *recognition* that the content was important. Frequently Pamela used Explicit Organizers to structure the class lesson so that the FD child experienced the important content in a variety of tasks. Each time she repeated the information, asked the FD children questions, and waited patiently when they did not respond immediately. In

addition, when children could not respond, Pamela guided them immediately into a task that demonstrated the correct response rather than repeating the previous ineffective cue. With this strategy, children not only focused more directly on the relevant content, but experienced the correct response in several ways.

In this study, Pamela continued to ask questions that focused students' attention on the components of the movement task and criteria for successful performance. However, instead of simply answering the question, Pamela used several different Explicit Organizers to encourage the FD children to become more actively involved in the lesson, using the same key words and phrases emphasized in the introduction as Explicit Organizer throughout the entire lesson. For example, children were often asked to demonstrate their understanding of the information by referring to a poster or recalling the teacher's explanation. Pamela made a concerted effort to include the FD children in the questioning process, instructing them concerning ways to organize the information for the response. She also provided cues to assist them in identifying the most salient aspects of the information needed for future decision making. In other words, she emphasized what was important and reminded students that they needed to remember the information and use it in future problems.

Strategies Contributing to Active Learning

Variable Formats. The use of variable formats appeared to contribute to storage and retrieval while increasing the involvement of FD children as active learners in this lesson. The variability in class presentation such as the order and kind of tasks seemed to increase the children's interest and active involvement in the movement content. Vasquez (1988) found that FD African - American third grade students demonstrated increased performance on four different paper and pencil tasks when the order of the presentation of the task was varied. In the present study, the teacher made an effort to vary the order of the tasks and to involve the FD children actively in the introductory portion of the class, They were frequently asked to demonstrate skills and appeared to enjoy the attention, becoming verbally and motorically more active and involved.

Interestingly, when asked to demonstrate, many of the FD children were initially unable to perform the task or the skill correctly. It was evident that until that time they had not been involved in the lesson and did not know how to perform. Typically, this is viewed as a behavior problem and students are chastised for not listening or paying attention. Pamela suggested that the inattentiveness of the FD children in her classes may have been associated with a *learning problem,* resulting, at least in part, from a mismatch of the analytical curriculum with the learning needs of the students:

> It is easy to understand why my FD children do not seem to learn as much as the FIs. During our talking sessions, they are often sitting close to other children — the boys are poking and punching their friends good naturedly, while the girls are fixing each other's hair. I have noticed this in the past and became quite angry that these same children could rarely answer my questions or follow directions. Since the inservice (on cognitive styles), I have worked much harder to deal patiently with these behaviors as learning problems. I use these children's names more often, have them sit close to me, and talk frequently with them during the introduction and practice sessions of the class.

Pamela's persistence in continuing to direct questions to the FD children and to include them in demonstrations was gradually rewarded by their increased ability to respond positively. This slow change process was noted in both Pamela's journal and the observation data. One particular pair of journal entries describes her initial frustrations with this process:

> 10/17: John continues to be a problem. His constant picking on other students in his group is driving me and the children crazy! So for today's class, I decided to put the spotlight on John . , . making him the center of the lesson — in positive ways. I started by explaining the tossing task emphasizing the importance of staying inside your hoop and tossing the bean bag above your head 10 times. Then I asked John to demonstrate. He started by acting silly, tossing the bean bag behind him and then racing after it. I reminded him of the directions but there wasn't much improvement. I worked hard not to show my impatience, instead asking Laura (FI) to demonstrate the task. As expected she performed perfectly.

> 10/19: Today I spotlighted John again; although I admit against my better judgement. We were working on tossing with control to a partner. Both students were standing in hoops about 10 feet apart, This time as I looked at John sitting with his group, I was pleased to see him up on his knees, leaning for-ward looking at me, as though he was hoping to be selected for the demonstration. I asked John and Steve to demonstrate next, figuring I would at least get some cooperation from Steve. I was really surprised! John actually tried to toss with control to Steve. He wasn't very accute, but I made a suggestion and praised him for a good effort. This time at least he knew what he was supposed to be doing. After a few tosses he became silly again and had to sit down, but I think it's a start.

Throughout the observation period, different FD children were "spotlighted." Several commented on the experience during the interviews:

> Demonstrating is fun! You get to show the others how to do it. You never know when you are going to get picked. Mrs. Phillips tells me to keep paying attention so I'll know what to do next time I'm picked (Male).

> I like it best when I get to demonstrate. Everybody watches you and if you do a good job, they tell you you're GREAT! (Male).

Observation data suggested that although the initial demonstrations with these children were not always effective in modelling the skill, they did assist the FD children to become actively involved in learning and to focus on the important concepts in the lesson. Further, FD children were rewarded socially by being selected for the class demonstration, The spotlighting technique within the Variable Format strategy seemed to invite students into the curriculum and give them a reason to concentrate the energy needed to access the retrieval cue or search for an alternate way to solve a problem. They appeared more likely to acknowledge the presence of skill criteria and become involved as active learners with an increased capacity to boost schemes into higher level programs.

Student Pairing

The Pairing strategy was chosen to utilize the well-documented preference of FD children to work in social settings (i.e., Goodenough, 1976). FD children enjoy the opportunity to work with other children and are quite effective at befriending classmates who may assist them in the organization, storage, and retrieval of information. In this research, when FD children (CEFT scores < 8) were paired with FI children (CEFT scores > 17), the learning environment changed perceptibly. Observation data indicated that the FI children acted as surrogate teachers, reminding their FD partner of the directions, the main concept, and facilitating the process of knowledge retrieval. The FI partner provided academic and social reinforcement (similar to that provided by the teacher) for the critical content by explaining why it was important to remember and use the concept to solve the problem or complete the task. This appeared to encourage the FD partner to focus on and store the information. The excitement created by the socially reinforcing environment seemed to increase the interest and attention of the FD child with the content, thus enhancing the utilization of mental energy.

FD children's comments regarding the pairing strategy reflected their enjoyment of the social setting and their increased awareness of the cognitive content of the lesson.

> I really liked working with Bobby (FI). He is fun to be with. We were able to do our (partner) balances without falling over. Bobby was the base because he is bigger than me. I always get to be the top — It is my job not to fall off. (Male).

> Susan (FI) and I worked on our dance all by ourselves. She has fun ideas. [In our dance] I was supposed to be the wind blowing Susan around. The teacher really liked our dance, and we got to show it to the whole class! (Female).

In the Ennis and Lazarus (in press) study FD second grade students changed the experimental research task from one that required multiple, simultaneous responses within a limited time frame to one that involved the serial ordering of movements within an extended time period. This change directly affected both the amount of memory storage space and the need to develop effective strategies to accomplish the task. In the Ennis and Lazarus study, FD and FI children were asked to intercept as quickly as possible a ball that had been roiled down a short ramp. Children began their movement perpendicular to the path of the ball. FI children began moving toward the base of the ramp and then continued to decrease their angle of approach and increase their speed to collect the ball close to the base of the ramp. FD children also began moving toward the base of the ramp, but then *increased* their angles of approach so that they arrived opposite the ramp at a point some distance from its base. They then turned to face the ramp and waited for the ball to come to them. These FD children essentially ignored the instruction to retrieve the ball *as quickly as possible,* focusing primarily on successfully collecting the ball. Thus the FD children deconstructed the task, completing each aspect separately rather than as an integrated cognitive and motor performance.

In the present research, the instructional strategy that paired FD with Fl children was also changed by the FD children to accommodate better their limited memory storage capacity, rigid retrieval processes, and low mental energy levels, The FD children did not appear to participate as fully in the cognitive, multidimensional nature of the tasks as did the FI children. Instead, they depended on the FI partner to remember the directions, organize the task, and retrieve the critical content from memory. The FD child, although not directly involved in the cognitive process, appeared to learn from the FI child and followed along with the task process. Thus, the Student Pairing strategy did not seem to assist the FD child to learn the process of knowledge storage and retrieval. Instead FD children permitted the FI child to do the cognitive processing, while they benefited from the products of the task. However, the FD children did appear to focus on the content to be mastered because the FI partner deliberately took them through the process. They seemed to learn the content knowledge (product), but not the cognitive process. For example, in one problem solving task:

> Jamie (FD) and Sam (FI) were paired to design an obstacle course that included balancing, rolling, hopping, and sliding movements. Pamela encouraged the children to position the equipment so that only two of the tasks in the obstacle course were to be performed while "moving on two feet," Initially, Jamie and Sam talked about the equipment they would use. However, once they began to set up the course, Sam took the lead making decisions about which pieces of equipment to use and where each piece should be placed. Jamie seemed quite satisfied to get the equipment Sam identified and position it according to Sam's instructions. After the obstacle course was completed, Jamie appeared to enjoy going through each station, performing the correct movements in the proper order. He demonstrated that he understood the problem and the solution, although he had not taken a leadership role in its actual resolution.

The potential merit of the Student Pairing strategy for FD children is determined by the educational goals that the teacher is seeking. If the goal is one of teaching FD children to manipulate complex information cognitively, the Pairing strategy is unsuccessful. Its value is compromised because it permits FDs to avoid the task complexity by allowing the FI children to retrieve the concepts and apply them in the novel situation. If, however, the educational goal is to have the FD children find success with the problem solving process and ultimately learn the content, then the Pairing strategy appears to be effective. In this study, the FD children seemed to avoid the processes in which they did not perform well. This is not surprising since it seems that for FD children the process of memory storage and retrieval requires more memory space and mental energy than they may be able to access.

Researchers are continuing to acknowledge that field dependence-independence is more than a personality construct reflected through social interactions. There is increasing evidence that it affects the efficiency and accuracy of performance in a wide range of experiences (Cochran & Davis, 1987; Goodenough, 1976; Kogan & Saarni, 1989; Witkin, 1978). In this research the Explicit Organization instructional strategy seemed to increase the effectiveness of FD children's performance by assisting them to recognize content that was most critical to

learning and to store and retrieve knowledge based on explicit statements. Evidence from these classrooms suggested that the Variable Format. and Pairing strategies excited and involved FD children in the learning process, encouraging them to utilize additional amounts of mental energy not typically directed toward learning. Although the Pairing strategy seemed to be enjoyable and interesting to FD children, its effectiveness as a process strategy was limited because it permitted them to utilize the cognitive abilities of their FI partners without mastering the cognitive organization and retrieval process. It did, however, enable them to learn the content — a valued outcome in most learning environments.

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