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Implications for Practice and Research

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One of the advantages of doing research with so many dependent variables is that you get a more complete picture of the effects of instruction and the interrelationships among variables. One of the disadvantages is that it is more difficult to communicate those results. The studies reported in this monograph (French, Werner, Rink, Taylor, & Hussey, 1996; French, Werner, Taylor, Hussey, & Jones, 1996) are important because the results are consistent across both experiments with different teachers, with different students, and at different times. They are important because, unlike much of the research in this field, all of the students in the experimental groups were significantly better as a result of instruction on all the key dependent measures. We think these studies will add to the knowledge base in pedagogy and on how to do research in this area. We present them, not as the last word on approaches to teaching and researching games and sport, but to initiate dialogue about how to teach games and sports to children and youth in our schools and how to investigate how to teach games and sports in our schools. We have two objectives for this article. The first is to review the findings of these two studies and draw implications of the results for practice and the second is to use what we have learned to draw implications for future research.

Physical education teachers want to know what is the best way to teach sport. Our journals and conferences are filled with anecdotal descriptions of best ways to teach that present convincing arguments for one method above another. It is our perspective that many of the questions asked about how to teach sport more effectively are questions that should require more objective data to support a claim for one idea over another. These results are presented to provide some objectivity to these questions. Is a tactical approach "better" than the traditional ways we have approached sport? Although there is always a danger in oversimplifying the results of a complex study, the following ideas seem relevant to any discussion of implications of what we found over these two studies.

Summary of the Results of the Studies

Minimal Levels of Object Control Are Essential

The results of both of these studies support the research done by Turner and Martinek (1992, 1995b) that suggests players must first have control of the object before they can use tactics. Lack of object control may also be a primary reason that other studies have not been able to demonstrate change in many strategy and skill variables. We suspect that Thorpe, Bunker, and Almond (1986) recognized

this problem when they suggested that simpler skills be substituted for more complex and difficult motor skills in order to develop an awareness of games tactics. However, no study done so far has chosen to substitute less difficult manipulative skills for the manipulative skills used in the game (e.g., throwing for striking in tennis).

Skill and Strategy Are Linked

Not only do players who have more skill execute skills better in the tactics they choose, but they also have more strategies to choose from. Players who cannot execute a clear to the back of the court as a defensive stroke cannot choose a clear to the back of the court as a strategy. Players in these studies who were not able to execute a clear shot to the back court had in effect reduced the playing space by half, making some strategies impossible to execute. Players who cannot keep a drop shot close to the top of the net lose the drop shot as an offensive skill against a player who has learned to hit down on the shot (smash). Thus, ability to execute skills constrains decision making. These findings are supported in the literature (French et al., in press; Johnson, 1991).

General Tactics Are Acquired Through Playing

If students have the ability to control the object, general awareness of the game (those that Thorpe et al., 1986, refer to as generic) seems to be acquired through game play without direct teaching for students in this age group. Although the tactical group spent considerable time on general tactics (without the racket) at the beginning of the unit and in tasks that were environmentally designed to elicit general tactics, the experimental skill groups seemed to pick up these tactics without explicit instruction in these tactics. This result is consistent with the McPherson and French (1991) tennis study done with college students.

Additional evidence that students seem to pick up some of the tactics used in the game by playing the game is supported with the scores of the control group (French, Werner, Taylor, et al., 1996). Students in the control group, after 3 days of practice (testing), did not make much change in the skills of the game, particularly those that required force production. They did, however, begin to increase their ability to contact the shuttle, which also increased their serve and game decisions.

Some Skill Is Acquired Through Indirect Teaching

The skill groups performed better than the tactics and combination groups in most of the skill tests and in execution in game play, although the difference was not statistically significant. However the tactical groups acquired a significant amount of skill through the environmentally designed tasks intended to elicit particular skills (e.g., the short/long game). The major increase in the drop shot skill test score for the strategy groups during the second 3 weeks of the 6-week study is particularly indicative of this development. The skill groups maintained a 15% advantage in the number of forceful shots used in their game play and had 10% fewer cooperative shots during game play.

The McPherson and French study (1991) would seem to indicate that in the game of tennis, skill did not improve until it was taught directly. The differences between these results may be attributed to differences between the difficulty of the motor skills involved in the sports of badminton and tennis. It is more difficult to

develop initial control of tennis strokes, particularly because of the force production requirements of the skills that are so problematic to beginners. Differences between sports are likely to affect the appropriateness of particular teaching orientations including a games for understanding approach.

Initial Stage in Game Play Is Cooperative

Initial game play for students who are just acquiring control of the object seems to be cooperative (keep the object going) from an observer's perspective. The game measures that identified the percentage of cooperative shots and the game execution (contact) of the groups is particularly revealing. A continued decrease in cooperative shots accompanied more offensive play for the experimental groups. Only after students could make contact consistently did they begin efforts at "winning" the point. Game play for the control group players who were limited in the ability to contact the shuttle and the less skilled players at the beginning of the study could be characterized as cooperative. This finding is consistent with work done by Marie Riley (cited in Robertson & Halverson, 1977) with elementary and middle school children and may reflect changes in skill more than a developmental characteristic of changes in attitudes toward competition. The term *cooperative* indicates an intent. At least some of the players in this study deliberately hit the shuttlecock to their opponent, as evidenced by their verbal protocols (e.g., "If I don't hit it right to him, he cannot return it, and it is no fun"). However, it is possible that other players were in fact trying to keep the shuttlecock in bounds and not necessarily play it to an opponent.

Differences in Language Development

Students who were given a more specific language to talk about skill and strategy had a slight cognitive advantage over those students who were not. Differences in task foci used in each of the treatment groups brought to an awareness level different information and therefore a different cognitive representation of what they were trying to do. These differences in cognitive representation seem to be represented in the language used by the students in each group. The point interviews and the open response cognitive tests provide some insight into the cognitive development of these players and the effects language development may have on performance. The analysis of the point interviews in the first study (French, Werner, Rink, et al., 1996) indicate that after 3 weeks the students were just beginning to acquire a language to talk about skill and strategy. The tactical group was perhaps more advanced in their language development, but described their intent largely in terms of actions (e.g., "I'm going to hit it"). Even with this group, there were few general strategies (e.g., "Keep it away from her") that may be a function of the fact that it took 3 weeks to begin to get students out of the cooperative stage of play and into competitive play.

In the second study (French, Werner, Taylor, et al., 1996), clear instructional differences in language development could be identified between the groups. Each of the instructional groups was beginning to develop a different cognitive representation of badminton that influenced how they interpreted events. This was particularly evident in the language they used for error detection in both the open cognitive test, as well as in the point interviews during game play. The language they used provides insight into what the players were attending to and what they were accessing during game play. The language of the skill group was primarily characterized

by execution statements, shot selection, and placement issues. The language of the tactical group was primarily characterized by the use of general strategies, shot selection, and placement. The combination group had characteristics of both the skill group and the tactical group. All of the groups were limited in their cognitive representation compared to experts, but were clearly developing a cognitive structure for interpreting their experience.

It is important to note that the cognitive structure these students were developing is related to the type of instruction they had. Experts have a far more advanced cognitive representation that includes skill, strategy, and the interrelationships between the two. All of these students were limited in their cognitive representation compared to the experts represented in the literature. As in investigations in other areas studying expertise (Berliner, 1986; Chi & Bjork, 1991), understanding the characteristics of experts does not necessarily provide prescriptions regarding the development of expertise.

All of the treatment groups were able to use strategies beyond their ability to verbalize them. This may mean that they were not consciously aware of the strategies they were using. If, however, it is true that language does facilitate thinking, then both of these groups were limited by language in terms of their ability to use strategy. The skill group was limited because it was not taught any strategy, and the tactical group may have been limited by a language for tactics that was too general for strategies and nonexistent for skill.

Sport-Specific Strategies

Strategies beyond those that might be considered generic to a type of game are probably sport specific. Although students may pick up the notion of keeping the object away from an opponent through game play, more specific ideas in the form of procedural if-then relationships may be specific to a sport. As evidenced by the point interviews, students in these studies did not get to a condition-action stage in their strategy development. While there may be merit in providing opportunities for students to work initially with the more general and generic tactics of a game, not providing a more specific language and detail for if-then relationships may inhibit the continued growth of a player. The tactics as they were presented by instruction in these studies focused primarily on general goal-driven tactics (e.g., hit it away from an opponent) rather than on condition-action concepts of how to achieve the goal. Specifically, condition-action sequences require a specific language. More advanced metacognitive skills used in sport such as planning and monitoring performance require this specific language (French, Werner, Rink, et al., 1996). The development of language is not associated with any particular approach to teaching. Whether a skill or tactic is presented and labeled to a learner, or whether a skill or tactic is elicited from a learner and then labeled may be irrelevant to language development.

No Affective Advantage for Approaches

When effective teachers are used, there does not seem to be any affective advantage to any of the approaches used in this study. All of these teachers were good teachers and effective teachers. All of the experimental groups were better than the control group. All of the students in the experimental groups, including the high- and low-skilled students, were very positive about the content both before and

after the study and were very positive about their experiences in their unit regardless of the teacher or approach used. We were not able to identify any affective advantage for any particular approach. This may be taken at face value meaning there is no different affective instructional effect for any of the approaches. It may also mean that the content of the unit, student learning, and the strong teaching skills of all the instructors were responsible for creating the high affect and that method was not as significant a factor. The groups were aware of the treatment they received but had no affective attitudes regarding the treatments. The point interviews in the first study (French, Werner, Rink, et al., 1996) did identify a negative affect for the control group, who were frustrated by their lack of success and responded with negative comments directed at both the game of badminton and themselves.

What was not addressed directly in these studies was the motivation of learners, which is a strong part of constructivist orientations to teaching and learning processes (Darling-Hammond & Snyder, 1992). Increased motivation should lead to increased involvement, which should lead to increased learner processing, which in turn should lead to increased student learning. There was no evidence of any motivation advantage for any group in this study. It is possible that the long-term retention measures not included in these studies may have detected some motivation and other differences.

Skillful Game Play Takes Time

The students in the 6-week study continued to improve in both skill development and game play throughout the 6 weeks. This time was needed by all groups to become competitive players. It was particularly true for the combination group who did not catch up with the other groups in skill or tactics until the second 3 weeks of the study and may have been overloaded by so many different kinds of tasks (skill tasks, as well as tactics tasks) with little time available for any of them. The low-skilled target students were particularly affected by needs for more time in the unit as a whole and more time to become proficient at tasks before the teacher moved on to a different task (Graham, Ellis, Williams, Kwak, & Werner, 1996).

Game Play Is Highly Contextual

One of the strongest variables identified in this study for game play was the skill level of the opponent. The tactics used by a player are to some degree dependent upon the tactics used by an opponent. For these studies, we controlled problems related to different ability levels to the extent that we could by ability grouping the players and matching like ability for game play. Due to the large number of participants and the time-consuming process of game play analysis, we were not able to collect game play data on participants playing different opponents. We found that in this uncontrolled setting many (but not all) players adjusted their level of play to the skill level of their opponent. In team sports players are likely to adjust not only their skills and strategies to their opponents but also their teammates (French et al., in press; Johnson, 1991). Knowing that an expert would perform a particular strategy in a particular situation is not as important to what players do as the ability players have to execute the tactics and the perceived ability of their teammates. Students take a pragmatic perspective on tactics. They talk about and try to execute those strategies that are within the context of their ability as well as their opponents and teammates.

Implications for Practice

Clearly the results of this study are context specific. These students were ninth-grade students, and badminton is but one sport that is an individual net activity. With few exceptions, all students in this study were brought to a level of skill that allowed them to contact the object with some reliability and to control the force and direction of that object to a level that made tactics a possibility. They acquired some skill and some strategy both without instruction through game play experience and with instruction that did not have that intent. It may take longer for students to achieve this level in other sports.

Given any one set of results, it is likely and even probable that the implications of those results will mean different things to different professionals. We offer these ideas on the implications of the results as a way to initiate dialogue in this area.

Take a K–12 Perspective

Although Thorpe et al. (1986) proposed their approach to games for understanding specifically for secondary students, the first idea we present is that there may be more merit in looking at the relationship of tactical approaches to teaching sport and games in the context of the total K–12 curriculum. For these secondary students, general awareness of the tactics of the game developed without formal instruction in the tactics. Tactics were used as soon as students became skillful at having some control over where the object went and were no longer challenged by keeping the object in play. The time spent by the tactics group in these more basic ideas (without the racket) and ideas such as returning to home base seemed almost wasted since the other treatment groups picked up these general strategies just by playing. A general awareness of games, it would seem, could be developed in the upper elementary and early middle school grades. At these levels it seems to make sense to reduce the skill requirements and to teach the strategy in less complex environments (fewer players, rules, reduced space, etc.). This is what Rink (1993) refers to as Stage 3 applications.

If general strategies were developed at the upper elementary grades, the secondary programs would be free to focus on gaining control of the object and developing sport specific tactics for play. Although we concur with Thorpe et al. (1986) that many students have been taught skill only to have it not be used in the game, there may be alternative explanations for why skill is not used in the game. Until students gain some control over the object, they cannot use strategies in a game or skills in a game. Thorpe and Bunker (1982) recommend substituting a less difficult skill. However, it is unlikely that students who use throwing and catching in a tennis game will be able to use the strategies they learned in throwing and catching before getting control of some basic skills of tennis (forehand, backhand) (McPherson & French 1991). Games are complex environments, and skills performed more easily in skills tests or practice situations (which are less complex contexts) are not likely to transfer unless the skills are actually taught for transfer.

Include Only Sports That Allow for Student Success

A second curriculum issue is related to the idea of what to include in the curriculum. As K–12 curricula are developed, teachers will need to give some thought to whether the curriculum taken as a whole can bring all students to a level

of game play where they can use tactics. If not, then perhaps serious consideration should be given to including only those sport forms that can be developed to this level. Three aspects of instruction would seem important here.

Give Students Time to Play the Game. In this particular study, students in all groups played the game of badminton during part of every class period. It was the game play that they identified as being the most "fun." Although the nature of the instruction differed, students in all groups also participated in instruction for a large part of every class period. Typically, sport units are organized so that all instruction in skill occurs at the beginning of the unit, and students are left to play at the end of the unit. Students will need some beginning level of skill to give them control over the objects and should have lots of opportunities to play the sport, not only at the end of the unit but also in conjunction with learning the skills and the tactics. Strong elementary and middle school programs can give students a background in manipulative skills that should make learning more specialized skills easier. Where students do not have the ability to play the game in its full context, the game should be reduced so that play can be continuous, participation is at a maximum, and tactics can be used.

Teach Skills for Transfer to a Game. Thorpe and Bunker (1982) indicate that skill teaching does not transfer to a game as support for a games for understanding approach to teaching sport. An alternative explanation may be that skills are not typically taught for transfer. Learners must be brought to gamelike conditions gradually (French, Rink, Rikard, Lynn, & Werner, 1991; Harrison, Fellingham, Buck, & Pellett, 1995; Rink, French, Werner, Lynn, & Mays, 1992). We have referred to this characteristic as content development (Rink, 1993). Whether the teacher uses a direct teaching or indirect teaching style to elicit responses from students, teaching for transfer requires that teachers establish progressions that gradually add the complexity of the full context of the game. Context in a game setting includes the number and nature of the skills required, the number of players, size of playing area, and rules. Although we do not have a great deal of evidence supporting the transfer of reduced game environments to the development of expertise in the full game, intuitively, most successful teachers have associated their success with this idea. The closer the controlled environment is to the context of the game, the more likely the transfer. The studies done investigating the use of a games for understanding approach with young middle school students have all used reduced game environments to develop both skill and strategy (Griffin, Oslin, & Mitchell, 1995; Mitchell, Griffin, & Oslin, 1995; Turner & Martinek, 1992, 1995a, 1995b).

Most of our complex sports require the ability to produce force, which is problematic for less-skilled students. Many typically less-skilled players in these badminton studies were able to develop enough ability to use skills to produce force (clear and smash) and therefore were successful at games strategies. The low-skilled target students in this study continued to have problems with force production skills (Graham et al., 1996). Force production skills were not acquired through just game play. Although the control group did show some improvement in many aspects of game play and in some skills, they made no progress in force production skills as a result of just testing or playing. The development of force-production skills of students is critical to the ultimate development of the use of strategy in any sport using manipulative skills. The tendency in our programs, even elementary

programs, is to put a major emphasis on accuracy in manipulative skills. A more appropriate emphasis is probably to help students learn how to use their total bodies with and without implements to produce and reduce force.

Provide Time to Develop Skillful Games Players. The students in these studies associated liking a sport with being good at it (Tjeerdsma, Rink, & Graham, 1996). Skill and strategy take time to develop. For some less skilled players in this study, this badminton experience was probably the first time they were able to really use and develop an offensive capability ("I can smash"), and it was an affective high for them. Students in this study were not bored by the 6-week unit and, with one or two exceptions (who had friends in other classes), were most positive about the longer units.

Sequence of Strategy and Skill Instruction. What is not as clear in the results of these studies are the questions related to the combination group. At 3 weeks in both studies, the combination group—which was taught both skill and strategy throughout the unit—was not as skillful in the skill tests, nor were they as skillful at game play. Although they "caught up" to some extent at the end of the 6-week study, the organization of the content (skill instruction and strategy) seems to be a definite factor in student learning. We have no reason to believe that this effect is a teacher effect. Observers who attended all of the instructional periods for both studies, the data we have on the lessons, and the affective responses of students support the high quality of instruction for both of these teachers. The fact that the results were similar for the 3-week study and the 6-week study lend support to the fact that we are looking at a real instructional effect.

The most reasonable explanation for the poor showing of the combination group at 3 weeks is that identified by McPherson and French (1991). Students may be overloaded, particularly at the beginning of the units. They were not able to spend a great deal of time on the strategy tasks in the unit or the skill tasks and therefore were less competent in both as compared to the other groups. Also, beginners may not be able to work with both a skill focus and a strategy focus at the same time. The implications of this finding present some real questions for the order of instruction. On the one hand, if teachers are going to provide the time to bring students to a reasonable level of skillfulness in both the skills and the strategies of the game, it may not make any difference which comes first, and there will be a catch-up effect. On the other hand, there may be some merit in carefully considering the order in which skills and strategies are taught.

In the McPherson and French (1991) study, some skill was taught initially to both groups in the semester-long course. In one group, tactics were taught first, and in the other group, skill was taught first. While the skill group picked up some strategies, the strategy group did not easily pick up the skill, but did seem to demonstrate a more sophisticated awareness of strategies in the verbal protocols taken at game play. Again, both groups played the game as part of both instructional emphases. This would tend to support the notion that at least some level of skill should be taught first so that a minimal level of control will permit the use of tactics. If students are at the point in their development where they have already attained the general awareness of the game, there would seem to be merit for this approach. Perhaps the time blocked out for skill before strategies are introduced does not have to be extensive. Some level of consistency in controlling the object may be all that is needed before both tactics and skill are integrated into the devel-

opmental sequence. What does seem to be clear is that daily lessons in which both are introduced may be contraindicated for beginning players.

Direct or Indirect Teaching Strategies? A second issue related to the games for understanding approach that merits discussion on the basis of the results of these studies is the issue related to the teaching of generic tactics and the use of direct or indirect instruction. Thorpe and Bunker (1982) clearly recommend that generic tactics should be taught. The implication in their work is that tactics should be taught indirectly. As we have previously discussed, there may be some real merit in teaching generic tactics at lower levels of the curriculum. However, it seems clear that for net activities, older students either already have developed a general awareness of tactics for net activities, or acquire them easily as a result of playing the game. More specific games tactics are necessary as students become more skillful and will need to be taught so that students acquire tactics as procedural knowledge of the game in the form of if-then relationships. The issue of whether these if-then relationships should be taught using direct or indirect teaching is probably the wrong question because it places the issue of direct or indirect instruction on an either-or basis.

Direct and indirect instruction are better considered as a continuum. Good teachers can and do use all points on the continuum as appropriate. What pedagogy does not want to suggest is that method, rather than objective, should drive instruction. There are times when teachers may very well want to use indirect teaching to teach if-then relationships in games tactics for broad concepts of the game. Rink (1993) refers to these levels as Stage 3 experiences in games. Teachers will also want to help students early on with the development of more advanced planning and monitoring skills that intuitively would lend themselves to problem-solving methodologies. There are also times when teachers may want to present an if-then strategy very directly, such as the give and go or screen and roll in basketball, or the overlap or takeover in soccer. In either case, regardless of whether material is presented directly or indirectly, at this development level it is important for teachers to label and bring both skill aspects and strategy aspects to a conscious level of awareness where they can become part of the cognitive aspects of playing the game.

Over the years, educators have continuously struggled with issues involved with decisions of whether to teach subject matter directly or indirectly. In reviewing the work of Dewey, Prawet (1995) has stated the following:

Although subject centered instruction overestimates students' receptivity to canned instruction, activity-oriented experiences underestimate their need for adult guidance, trusting too much in the child's own innate capacity to organize or make sense out of individual experience. (p. 16)

Progression of Skill, Strategy, and Language. Skilled teaching of games may involve the development of an interdependent progression for skill, strategy, and the language for both. This is probably the most speculative point we make about this data, but it makes sense to us. Skilled performance is being developed in all aspects simultaneously to some extent (e.g., awareness or cognitive representation of skills and tactics, and ability to perform in modified/game contexts). Some aspects of performance may constrain development of others at particular points in the progression toward expertise. At any one point in the development of expertise,

players may be limited in one progression by an inadequate development in a different aspect of the game. For example, tactics development is initially limited by skill; skill development after initial levels of control may be limited by a lack of opportunity to develop tactics; and both skill and tactics may be limited if the teacher does not at some point develop language for both skill and tactics that would facilitate more advanced levels of performance. Although performance is not dependent upon language, language allows both skill and strategy to be handled at a conscious level and in metacognitive strategies that are part of expert performance.

Assessment of Instruction

In the rush to embrace newer directions in assessment, physical educators have recommended that teachers assess game play (National Association for Sport and Physical Education [NASPE], 1995). How a student plays the game fits all of the characteristics of performance-based authentic assessment currently endorsed by the education community. Although gross estimates of how students use skills and strategies in games can certainly be obtained through observation of game play, some caution based on our experience with assessing game play seems warranted. Game play is highly contextual. The biggest factor we determined in whether a student will use a strategy or a skill is the level of skill of the opponent. Therefore, students must be matched with opponents of equal skill level or tested with students representing a variety of skill levels. It was not difficult to match students for equal ability in singles badminton play, but it might be most difficult to do in a team sport. As students gain skill in competitive situations, they respond to more difficult shots delivered by their opponents, which means they may be able to execute a skill correctly as a response to a less offensive player but not be able to execute the skill correctly when responding to a more skillful shot by an opponent.

If teachers want to know whether students can perform a skill, skill tests should not be ruled out as best measures of skill development. Most good skill tests have been validated by a positive correlation between the ability to perform the skill in a skill test situation and the ability to use that skill in game play. An assessment of game play will also not tell you what knowledge is being used and how it is used in game play. Game play assesses only the accuracy of the implementation of those decisions. If teachers want to know what knowledge and strategies students are aware of, there are better methods. In this study, having the students assess videotape game play performance was particularly discriminating.

Implications for Research

Most good research tends to ask more questions than it answers. The following ideas have implications for future research in this area.

The Context

It would be premature to generalize the results of this study to other contexts. This is particularly true in terms of the age level and the content area investigated. High school students developed general strategies and some skill as a result of playing the game of badminton that younger students may not. Indirect teaching was successful in eliciting skill for this sport. Other research (McPherson

& French, 1991) suggests that it may not be possible to pick up adequate amounts of skill without more direct instruction in sports that use manipulative patterns that require the production and control of large amounts of force to send an object. Also, it may not be possible to pick up general strategies by just playing the game in more complex sports such as invasion games with many specialized player roles.

It is clear from the results of these studies that a tactical awareness approach to teaching sport is not the silver bullet its advocates might have hoped. It is also clear that the approach does have merit as an indirect teaching strategy to sports and games in a physical education setting. Continued research with different age groups and different sports will help educators to understand more fully when indirect approaches are warranted and when the teacher needs to be direct.

Retention and Transfer Issues

One of the limitations of these studies is that the retention period (4 days) for the testing was not long enough to identify the long-term effects of these instructional interventions. The steady progress of all of the groups and the accelerated learning of the combination group in the last 3 weeks of the 6-week study (French, Werner, Taylor, et al., 1996) would seem to indicate that progress was continuous on most dependent variables. Would the combination group who had the highest perception of their ability at the end of the 6 weeks (Tjeersdema et al., 1996) catch up and surpass the other instructional groups in retention? The second issue that we were not able to answer is also important in any discussion of a games for understanding approach. Would what the students learned about badminton transfer to other net activities? Future research should build into the design some way to begin answering these important issues.

Nature of the Intervention

The results of these studies suggest that teachers need to think in terms of using both direct and indirect teaching approaches to both skill and strategy. Deliberate plans for intervention and very specific descriptions of the interventions used in research will be critical for understanding the best placement of direct and indirect teaching for different aged students, with different content, and at different times in the instructional process.

One consistent result of these studies was the poor performance (in everything but language development and perceptions of ability) of the combination group at the end of 3 weeks in both studies. To a large extent, the combination group seems like the most logical instructional approach for teaching both tactics and skill; therefore, it is very important that future research include different ways of packaging the order and integration of both skill and tactics instruction.

Measures of Dependent Variables

The difficulty of any attempt to show change in performance is that regardless of what measures you use, that measure can only give you information on one level/aspect of that domain. This means that even if you sample multiple domains (skill, cognitive, affective, game play), the tool you use to measure each of these is designed only for a single aspect of that domain. As discussed earlier in this mono-

graph in Rink, French, and Tjeerdsma (1996), sport performance is multivariate with complex interrelationships among skills and strategies. Researchers want measures that are going to discriminate treatments and will be better served if they stop talking about cognitive, skills, game play, and affective learning as though the ideas represented single dimensions. Each variable can only represent one aspect of each of these domains of learning. It will be important for researchers to select and describe more specifically the variables selected as independent variables and to collect information on as many dependent variables as possible.

Game Play. Measures of game play will most likely be sport specific. Although there may be some merit for assessment in thinking in terms of generic categories across sports, for research purposes, it is not likely that a valid generic tool will be appropriate across different sports. The skill level of the student, the opportunity to respond, and the specific nature of the sport beyond Thorpe et al.'s (1986) generic categories of games may all make the notion of a generic game play instrument wishful thinking. For example, for these studies, the category of "cooperative play" or "bloopers" made sense and was very important. Once players move out of the cooperative stage of play, that category would not be necessary. In these studies, students had a very high opportunity to respond in 10 minutes of game play, whereas in a team sport like baseball, it took five games to get a large enough representation of player responses (French, Spurgeon, & Nevett, 1995). As more players are added to a game, the amount of time needed to observe game play increases proportionally. Adequate opportunities to make decisions with the object (ball, implement) are needed. Examining only one aspect of decision performance (i.e., "off the ball" play) is not an adequate representation of decision performance.

Even with large amounts of time observing game play, one may not obtain an adequate sample of "the game." For example, against one opponent in tennis, a player may use a limited set of tactics because those are the ones that work. One still does not know if the player can adjust to a new opponent where different tactics may be needed. Another example occurs when some tactical situations do not occur in the game selected for observation. For example, some game situations may not ever occur in a baseball game. In a team sport, one team may use or may not use one specific offense or defense. In these cases, other forms of measurement such as situation interviews (French et al., in press; McPherson & Thomas, 1989) and videotape procedures similar to those reported in French, Werner, Taylor, et al. (1996) may be more appropriate ways to sample knowledge of specific game situations of interest.

One other issue related to design of observational instruments is the complexity of game play in most team sports once player positions become highly specialized and formal offensive and defensive schemes are introduced. Team play becomes more specific to a given offense or defense and less generic when the "full" game is played. Appropriate positioning by players, player movement, and game decisions are offense and defense specific. Observational instruments must be tailored to the specific offense and defense. For example, off-the-ball movement in one offense may be quite different from off-the-ball movement in another offense. This is especially important when designing instrumentation for intervention or instructional studies. The instrument should reflect what was taught.

Point Interviews. If any attempt is going to be made to ask players to share their strategies, researchers are going to have to attend to the knowledge base in

psychology that provides direction for how to validly solicit information from participants and how to interpret it. As we discovered in our second study, it is very easy to lead students to give you a response, but the responses are not valid measures of the strategies actually being used.

We believe the best probes for point interviews or other forms of retrospective and talk-aloud procedures are those that do not specifically direct attention to a given aspect of performance. Ericsson and Simon (1993) suggest use of probes such as, "What were you thinking?" and detail reasons for why this is a more appropriate probe. McPherson (1993b, 1994) has used these probes and documents trends across the levels of expertise that may be used for comparison purposes. As we stated in the earlier paper (French, Werner, Taylor, et al., 1996), the use of other probes makes comparisons difficult.

The Ericsson and Simon (1993) book appears to be the best reference for those interested in using verbal protocol procedures (situation interviews, point interviews, talk aloud). Reitman-Olson and Biolosi (1991) also present a thorough review of techniques to assess other forms of knowledge representation. Examples of studies that have used verbal protocols and terminology commonly used in cognitive problem solving include the work of Voss (1988), Chi (Chi, Glaser, & Rees, 1992; Chi, Hutchinson, & Robin, 1989), and McPherson (1993a, 1993b, 1994).

Use of Multiple Measures. Other authors (McPherson, 1994; Thomas, French, & Humphries, 1986) have stressed the importance of multiple measures of cognitive and skill performance. To date, many of the instructional studies have used a paper-and-pencil knowledge test, skill tests, and game play as measures. The traditional paper-and-pencil knowledge test provides limited information concerning awareness or cognitive representation of skills and tactics. Other techniques are available (see Rink et al., 1996) that are more informative. McPherson (1994) provides examples of other assessment techniques as well. Further research is needed using a variety of techniques because there are limitations to each type of assessment.

Design Problems. The most critical aspect of any design investigating a games for understanding approach is going to be the length of the intervention. The students in this study needed 6 weeks of good instruction to move out of the cooperative stage of development and into competitive play. They had enough time to develop both skill and tactics. Badminton uses manipulative skills and strategies that permit the student some success at early stages of learning. Although it is possible to reduce the nature of the game in team sports with many players (5 vs. 5 in soccer), such a decision only adds one more layer to the question of transfer. Does skillfulness in the modified form of the sport transfer to the full game when it is played in its full context? Should the full sport or game appreciation be the focus of physical education programs?

The intent of this monograph has been to present the results of the work we have done in a manner that facilitates the dialogue in research and practice in this important area of investigation. We made some mistakes that hopefully will help others to avoid similar problems in their own research. Like all good research, we have generated more questions than we have answered, and we hope these questions will be new beginnings for continued research on sport instruction.