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Gameplay Decisions of University Badminton Students

ABSTRACT This study used a modified multiple baseline approach across groups to determine the effects of a creative problem-solving intervention series on the game-play decision making of university badminton students. All subjects were videotaped five times (once per week) in five-minute game play sessions with the same partner each time. One group (experimental) underwent creative problem-solving interventions on a weekly basis. Following the interventions and videotaping, each five-minute segment was coded via computer for frequencies of occurring tactical decisions. Results suggest that although certain categories did not generate positive support, the experimental intervention tended to continually improve decision-making in the most strategic categories (running opponents and jamming them) during game play in badminton.

INTRODUCTION A recent trend in the physical education teacher education (PETE) literature has been to study how teachers emphasize the tactical decisions made by students during game play. This pattern is in contrast to the use of the traditional "technical" model which is based typically on the multi-activity model in which teachers expose students to skills and some game-playing in a three-to-four-week activity unit. The intent of the technical model is to focus on skills first and then games with little emphasis on strategies. The "tactical" model was developed in the United Kingdom from the Teaching Games for Understanding Model (GFU; Curtner-Smith, 1996; Smith, 1992; Turner, 1997) and allows students to be placed into game play situations early in units so that they may see the need for individual skill development while emphasizing strategies.

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The categorical arrangement of games is stressed within the GFU model with four categories used: invasion games, net games, target games, and field games. The tactical model has become a primary area for PETE research (Griffin, 1996; Mitchell, 1996; Turner, 1996, 1997; Werner, Thorpe, & Bunker, 1996), with a new line focusing on the relationship of these categories to the perceptions and decision-making processes of students (French, Werner, Rink, Taylor, & Hussey, 1996; French, Werner, Taylor, Hussey, & Jones, 1996; Graham, et al., 1996; Rink, 1996; Rink, French, & Tjeerdsma, 1996; Tjeerdsma, Rink, & Graham, 1996).

The researchers at The University of South Carolina led a collaboration effort on a monograph in the *Journal of Teaching in Physical Education* which focused primarily on tactical approaches to teaching sport and games (Rink, 1996). The results of the studies indicated that, in general, students who participated in units taught with a tactical emphasis were able to obtain more out of the badminton instruction than those students taught with a primary skill emphasis or a combination of tactics and skills (Graham et al., 1996; Rink, French, & Graham, 1996). In addition, findings pointed to the greater gains in achievement and perception for students in six-week units as opposed to three-week units (French, Werner, Rink, Taylor, & Hussey, 1996; French, Werner, Taylor, Hussey, & Jones, 1996; Graham, et al., 1996; Tjeerdsma, Rink, & Graham, 1996). Longer units appeared to offer enough practice opportunities for lower-skilled students who were on the verge of achieving success within the units. However, the findings pointed that students needed to have the minimum-required skills in order to make tactical decisions (Rink, French, & Graham, 1996).

The literature which has just now emerged on decision-making has opened the profession's eyes to the belief that the process of making decisions in game play is vital in high-level sport participation. An important question to ask all skills' mentors is as students begin to master skills and make strategic decisions during-game play, are there any stimuli which affect certain game decisions? An intervention for the current study focuses on creative problem-solving and its effect on game decisions.

Problem-solving has been used in educational research to increase effectiveness within the classroom, focusing on the integration of problem-solving techniques with teaching effectiveness and student achievement. One such study found a

positive impact of problem-solving techniques on the pedagogical beliefs of preservice teachers who teach math (Emenaker, 1995). In other problem-solving research, Getzels (1975) found that the ability of art subjects to find and formulate problems directly affected the originality and inventiveness of their solutions. Therefore, creative problem solving was beneficial in obtaining more and better outcomes in practical affairs, science and art. Shean (1979) used creative problem solving with students of school administration. A ten hour creative problem workshop was used to influence the divergent thinking processes and organizational perceptions of the students. Shean (1979) found significant differences between the control and experimental groups in creative fluency, flexibility and originality. The experimental group also had a low positive change in using divergent thinking in their organizational perceptions. Little is taught, though, in teacher preparation at the college level on creativity and creative problem solving. Teacher educators surveyed by Mack (1987) indicated that they had not been exposed to the teaching concepts of creativity with only 11% of the subjects indicating that they recieved their knowledge of creativity concepts as a student.

Few problem-solving studies have been published in the physical education literature. Some researchers have focused on discovery of movement (Cleland, 1990) and games (Kraft, 1987). Research has looked at how problem-solving fosters creative-thinking with disabled children (Sherrill, 1985), while Zhang (1991) described problem-solving's impact on various aspects of sport in general. Few studies in physical education, though, have studied the impact of a problem-solving emphasis on the tactical decisions of athletes or students.

The purpose of this study was to determine the effect of creative problem-solving interventions on game-play decision making of badminton students. Two research questions emerged as the focus of the study: (a) Were there differences between groups in the frequency of tactical decision-making due to the creative problem-solving intervention and (b) did lower skilled and higher skilled students make more decisions following the interventions? It was hypothesized that the better decision makers would generate the most improvement in the categories of jamming and running opponents.

METHODS

The students ($N = 24$) within a physical education teacher education (PETE) badminton strategies course at a mid-size Southeastern university were ranked according to ability level. Even

though the two groups were divided by equal skill ability (high skill and low skill), the highest skill level of any subject was advanced beginner, primarily because all subjects had very limited experience in badminton prior to the study. Each subject was randomly assigned to a partner of similar ability level to engage in game-play for five minutes following each of four problem-solving intervention stages led by an expert in that area. The subjects then were randomly assigned to either an experimental group (n = 12) which received three 10-minute mini-sessions and one hour-and-an-half session (during class) on creative problem-solving and a control group (n = 12) which did not receive the intervention. No subject in the control group received any extra game-play practice at any time when the experimental group engaged in the intervention sessions (see section describing the interventions). All subjects provided written informed consent to participate in the study with the freedom to drop out at any time. The subjects in the experimental group agreed to come to each class 10-minutes early for the three 10-minute sessions.

Standard activity skill teaching methods including explanation, demonstration, analysis, and drills used were used with all members of the study. The objective of the intervention was to have the experimental group transfer the general creative problem solving techniques to decision making in a game situation. The experimental group was not told to transfer the creative problem solving techniques to the game situation. The intent for the experimental group subjects was that they would use problem solving in their overall strategic decision making choices during play and thus make more effective decisions.

The Interventions

The experimental group was exposed to a series of generic creative problem solving sessions. Half of the sessions were devoted to idea finding while learning to view things differently and the other half of the sessions were devoted to using seven steps of creative problem solving adapted from Parnes' 1981 work (Osborne, 1963). Those seven steps consisted of (a) the mess, (b) fact finding, (c) problem finding, (d) idea finding, (e) solution finding, (f) acceptance finding, and (g) new challenges. The fourth step (idea finding) is what makes creative problem solving unique from other problem solving approaches.

Each of three camcorders was positioned on a gymnasium balcony so as to videotape one of three badminton courts on which singles play was engaged. A data baseline was established prior to any intervention stage for each subject. This

was accomplished by videotaping a five-minute stage of each of the assigned partner groups in the same way in which the subjects would be filmed throughout the study. Videotaping occurred immediately following the intervention sessions each time so that no extra practice or information would be obtained that would skew the results. That is, the videotaping schedule would be able to determine if any immediate effects occurred following each problem-solving intervention stage.

DATA COLLECTION

After the interventions and videotaping concluded, each five-minute game-play videotaped segment was coded by one of three observers for frequencies and probabilities of occurring tactical decisions by subjects. The raters did not know which group subjects were in at the time of rating. In addition, the observers coded with a computer program for rates per minute of these occurring decisions. Not only were data studied in terms of occurrences, but also in terms of the interactional patterns based on stimuli-influenced responses. To simplify, tactical responses were studied to determine if certain decisions were more prominently associated with certain responses made by opponents. Reliability was established at .89 interobserver agreement between three observers using laptop computers and a modified instrument designed to collect information on tactical decisions in badminton game-play (French, Werner, Rink, Taylor, & Hussey, 1996) and established to be used with a computerized systematic observation instrument's keyboard (Hawkins, & Wiegand, 1989; Sharpe, Koperwas, & Wood, 1994). The game-play instrument (French, Werner, Rink, Taylor, & Hussey, 1996) was modified to only include effective, tactical categories related to decision-making. The categories of decisions were (a) hitting at the opponent's feet; (b) making the opponent run; (c) making the opponent move to the side; (d) making the opponent move backwards; (e) making the opponent move up; and (f) jamming the opponent. Jamming is hitting the shuttlecock into the body of the opponent so that it is difficult for the opponent to hit the shuttlecock with any kind of leverage. If a shot did not land within the court, it was still coded if it showed the intent to make a certain decision. It must be emphasized that the difference between the running cateogry and categories in which opponents are moved was that running involved moving opponents more than two steps in any direction. The other categories required only one-to-two steps.

Data Analysis

A modified single case B-A-B-A-B-A-B-A-B research design (B = baseline phase; A = intervention phase) was used to determine the effects of the interventions on the six dependent variables of the control and experimental groups. Sub-groups studied included low and high ability learners. Gender was discontinued as a subgroup because of the low numbers of females in the overall group. In addition to the baseline design, Wilks' Lambda was used to provide statistical support (Kazdin, 1982).

RESULTS

Results from the multiple baseline approach revealed a positive trend favoring the experimental group. In only one category between experimental and control groups did a major shift from the trend occur (hitting at feet). However, upon comparisons between groups across ability levels, the experimental beginning group's results included more of a positive trend throughout three of the four intervention phases with a higher success rate in all categories except two (hitting at feet and no difference in the moving opponent from side to side category) when compared with the control beginner's group. The experimental advanced group finished with higher frequencies of success in all categories except two groups (feet and side-to-side) than did the control advanced counterparts. In looking at the trends between intervention phases, these latter two groups demonstrated that the experimental phase typically demonstrated more of a continued positive climb (with one decline from one intervention phase in each category) than did the control advanced group which showed more of a haphazard trend in most categories. Once again, the experimental advanced group performed at a higher level in both of the most strategic areas (jamming opponents and running them). An interesting subnote is that the experimental group outperformed the control group in all comparisons within these two categories. A final note is that a typical pattern existed in which both control and experimental groups typically performed in similar trends for the first three data points in the baseline. Results suggest that although certain categories did not generate positive support, the experimental intervention tended to continually improve decision-making during game play in badminton in the categories hypothesized as those which would mark more decisions by the experimental group (jamming and running opponents). This was evident between control and experimental and also between them across ability levels (See Figure 1). By viewing the other variables in figure 2, the trend seen in the first three figures is more evident.

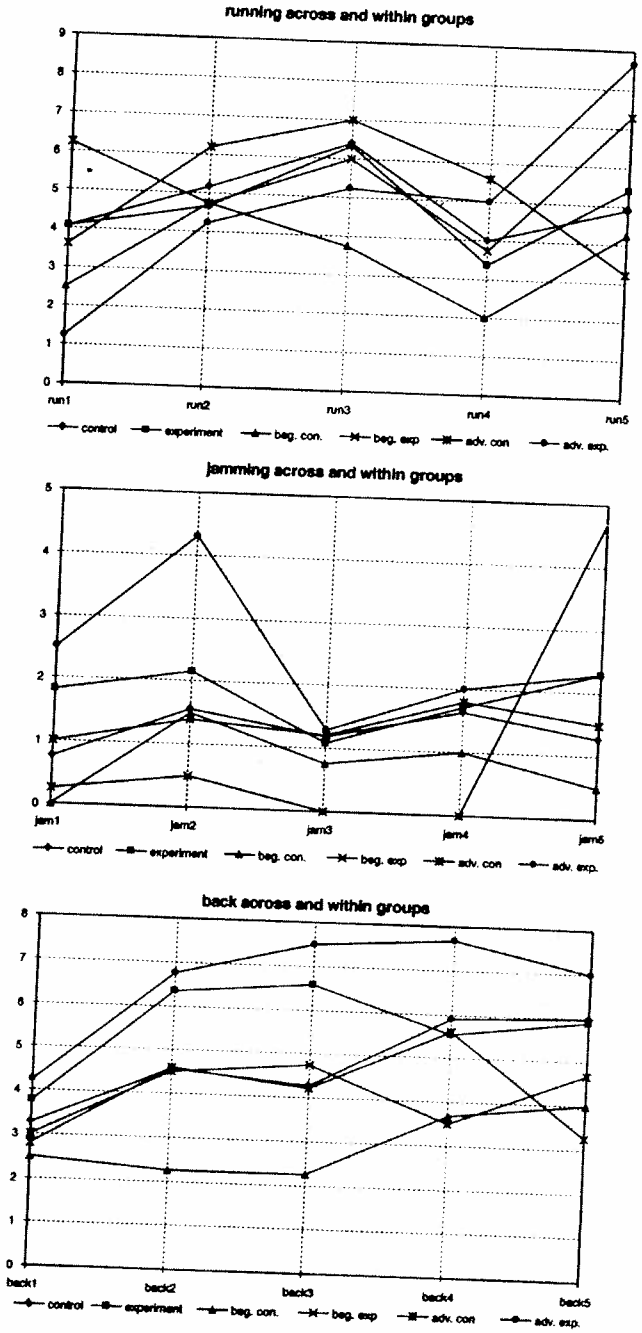

FIGURE 1. Across and within groups comparisons of running opponents, jamming opponents, and moving opponents back.

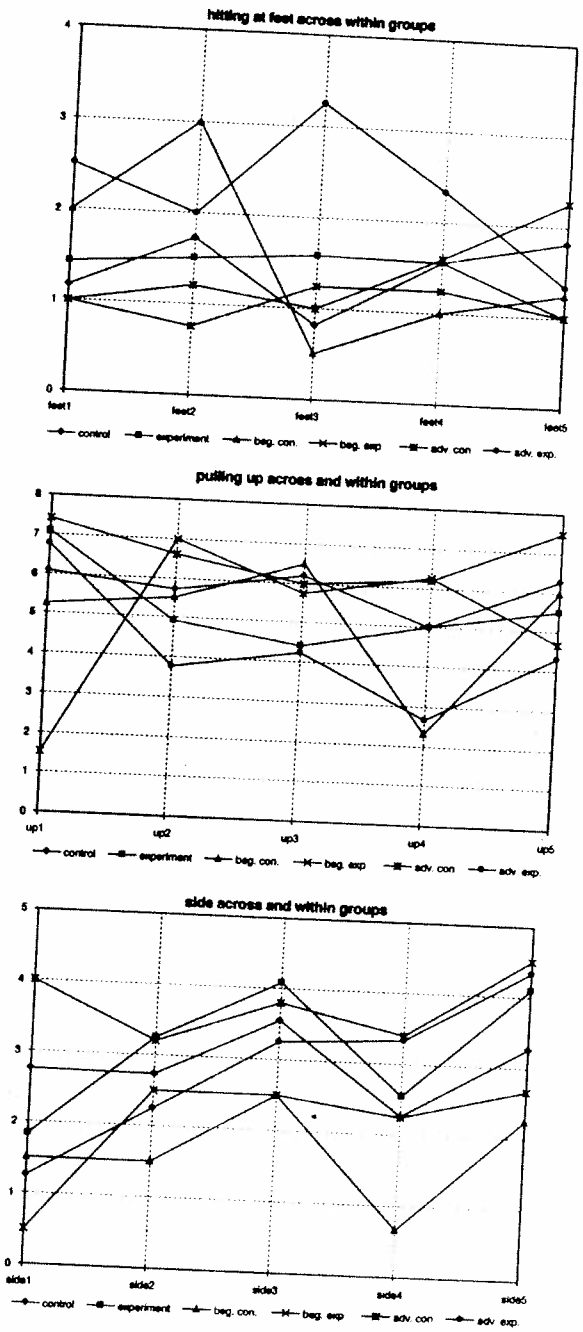

FIGURE 2. Across and within groups comparisons of hitting opponents' feet, pulling opponents up, moving opponents side-to-side.

To further support these findings, the gain scores for the experimental group were greater on all categories across groups and within groups except for the same categories of hitting side-to-side and at feet.

Statistical Support

In addition to the results derived from the multiple baseline approach, it is normal procedure for appropriate follow-up tests to be run in order to provide secondary support for results (Kazdin, 1982). Wilks' Lambda revealed a statistical significant difference between the two major groups (experimental and control) in the frequency of decisions from the first baseline to the final baseline, $F(2, 13) = 14.65$, $p = .0001$. The differences were significant at an alpha level of .001. Not only were scores significant between groups but within groups as well, demonstrating differences between ability levels, $F(2, 13) = 34.26$, $p = .0001$. This also was significant at the alpha level of .001.

DISCUSSION

It is obvious that the intervention had an effect on the frequency of tactical decisions made between the control and experimental groups, but primarily in the categories which demonstrated higher quality of strategies being attempted. In addition, regardless of ability level, the experimental group made more quality decisions (running and jamming opponents) than did their counterparts.

Results indicate that the creative problem-solving intervention affected the experimental and control group, but a positive difference was not evident in every category. This is not unexpected if the demands and consequences of these two skills are more closely examined. The ability to hit consistently at the feet of the opponent, especially under the constraints of this training environment, suggests the frequent use of the overhead smash. This is one of the more difficult skills to develop and may not be a part of either groups repertoire until a later date. However, utilizing other, more easily acquired strokes, it is logical that the more strategically adept students would attempt to force their opponents to cover more of the court. It must be noted again that the subjects had very limited experience in badminton prior to the study.

Perhaps the most significant difference between groups was the higher number of strategic decisions made by the experimental group in the categories of running opponents and jamming. This seems logical in that it indicates attempts at utilizing known successful strategies which strongly correlates with creative problem-solving in a sports environment. Running the

opponent is the single most important strategy for success at this level of badminton. It is also the strategy that requires the most divergent thinking process thus calling on a greater variety of decisions.

When comparing within groups, the lower and higher skilled students were affected by the intervention in the same way in that the experimental subjects who were lower and higher skilled made more strategic decisions by using the categories of running opponents and jamming them. Once again, this meant that those in the experimental group, no matter what skill level, were moving opponents all over the court. That is, the lower and higher skilled students of the experimental group made more decisions in the categories. This is contrasted to the control group's moving opponents one-to-two steps up, back, or sideways. This is expected because the moving of the opponent (running) is a much more complex strategy than moving an opponent a step or two sideways or backwards. The experimental group had more ability to problem solve; therefore, they performed better on this task than did the control group.

As far as the trend occurring similarly through the second intervention and videotaping baseline phase before a change occurred between groups (experimental and control), that may be due to the fact that the initial intervention sessions were only ten minutes in length. This amount of time spent on creative problem solving is short and it was not until the third ten-minute session and the last 1.5 hour session that the major changes took place. It is obvious that creative problem solving cannot be totally assimilated in two short ten-minute sessions.

The total gain scores for the entire intervention revealed a higher increase for the experimental group across and within groups (low- and high-skilled). This indicates a positive effect which the problem solving intervention had on the badminton students.

Implications

It is possible that with more research in this area in various types of sport activities and at different levels (e.g., elite athletes), teachers and coaches may begin implementing strategies of creative problem solving. With such an implementation, this may mean better decision making across the board in physical education and sport. However, it would be prudent to use a variety of research methodologies to analyze different research questions related to this topic. For example, qualitative methods may be able to probe the minds better of

participants and teachers who have used creative problem solving. Also, a more positivistic approach may enable more generalizability for researchers when they reach conclusions from studying this topic. For an introductory study, these findings enable us to see an initial need to study more about creative problem solving and its effect on coaching and teaching sport activities.

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