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ELITE COACHES' PERCEPTIONS OF THE CHARACTERISTICS OF DECISION-MAKING THAT DISCRIMINATE BETWEEN EXPERT AND NOVICE BASKETBALL PLAYERS

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ABSTRACT

This study was aimed at discovering what elite coaches perceive to be the critical characteristics of decision-making that distinguish expert players from novices in basketball. A qualitative method of inquiry (the long interview) was followed. The data were gathered during interviews with five elite coaches. A framework to define decision-making was created through a systematic analysis of the data by two investigators with substantial background in top-level basketball. The key discriminating variables as defined by the elite coaches were: Anticipation (experts know where to look and have the ability to read the game better than novices); cognitive knowledge (experts have a more comprehensive knowledge of the rules and of tactics), self-knowledge (experts have more accurate sense of their own abilities) and the quality of memory processes (experts make decisions faster than novices and show more adaptability in their decision-making). The results of this research confirm expert-novice differences in anticipation and quality of memory processes found in other studies of decision-making in sport. The results also underscore the importance of knowledge structures – declarative, procedural and personal – in the development of expertise in sport performance.

Key words: Decision-making; Expert-novice differences; Coaching.

INTRODUCTION

Decision-making has been defined as a process of arriving at a conclusion based on incomplete and uncertain information. With regard to sports, decision-making has been conceptualized as the process of determining appropriate responses about movement performance within the context of a performance situation (McPherson & French, 1991). A variety of components have been related to the process of decision-making, including anticipation, recall and response selection and sport intelligence (Dorfman, 1977; Goulet *et al*., 1989; Proteau *et al*., 1989; Tenenbaum & Bar-Eli, 1993; Wrisberg, 1993; French & McPherson, 1999). Research about the nature of decision-making in sport frequently has focused on describing the apparent differences between expert and novice performers in an effort to identify critical variables that change as performers gain expertise.

Anticipation

Dorfman (1977) referred to anticipation as the process of identifying and interpreting the information required for predicting situations. Interpretations are derived primarily from comparing experience with past events to the incoming information in relation to the present events in order to predict the next possible events. Research has demonstrated that experts are more effective than novices in their ability to anticipate what will happen in their sport. Abernethy and Russell (1987) found that experts collect a greater amount of essential information from cues because they can use the early cues better than novices can. Rothstein (1985) discovered that experts perceive more information in one glance than novices do because experts tend to recognize patterns rather than individual stimuli. Anticipation can be learned and improved in order to maximize the speed of perception (Tannenbaum & Bar-Eli, 1993), and experts have had the benefit of years of practice to gain this advantage.

Recall and response selection

In terms of recall and response selection, experts are better at coding and recalling situations than novices. The ability to remember the past experiences and associate them with current game situations enhances the quality of decision-making in sports. Experts have been found to have superior capabilities for checking, encoding and retrieving structural aspects of ball sport displays (Allard & Burnett, 1985). Recall differences between expert athletes and novices have been reported under structured and unstructured game situations in volleyball (Starkes & Allard, 1983), hockey (Starkes, 1987), badminton (Abernethy, 1991), soccer (McMorris & Beazeley, 1997) and tennis (French & MacPherson, 1999).

Investigations into the mechanisms that support recall are not new. An early report by Chase and Simon (1973) attributed the amazing recall abilities of chess masters to "information chunking" or the grouping of multiple cues into a single unit for processing. They hypothesized that recall is dependent up on a series of cognitive processes, including the coding of meaningful "chunks" of information during initial experiences, labeling and storing of these chunks in the memory, and decoding the chunks at the time of recall in subsequent experiences. Allard (1982) described chunking as the ability to organize information into memory patterns (configurations) and the coding/decoding of information as the processes of recognizing, storing and retrieving relevant information configurations. Chunking has been studied by a number of researchers in sport. Williams *et al*. (1993), for example, found that soccer experts recall large perceptual chunks within the first five seconds of viewing but only for structured game situations.

Efficiency in chunking, encoding and decoding relevant game signals results in an improved capacity for experts to support decision-making within the time constraints of a sport like basketball. Different levels of individual cognitive adaptation have been found in experts' abilities to perceive sport-specific information from the environment, the speed of processing in the memory, the rapid retrieval of the relevant information patterns and the organization of information for accurate decision-making (Garland & Barry, 1990).

Athletic intelligence

Athletic intelligence was the term used by Papanikolaou (2000) to try to encompass the combination of different kinds of knowledge that impact on expert performance in sport. It is well-documented that the expert player perceives and cognitively arrives at decisions based on

in-depth knowledge (Starkes, 1987; Chamberlain & Coelho, 1993; Helsen & Pauwels, 1993; Kioumourtzoglou *et al*., 1998a; Kioumourtzoglou *et al*., 1998b; French & McPherson, 1999). Two kinds of knowledge - declarative knowledge and procedural knowledge - have been reported to be critical in making correct decisions during sport performance (Allard & Burnett, 1985; Starkes, 1987; Tenenbaum & Bar-Eli, 1993) and may be the basis for "sport intelligence".

Declarative knowledge is related to an understanding of the game concepts, rules of the game, goals, sub-goals, player positions, etc. (Allard *et al*., 1993). In the theory of motor learning, declarative knowledge is stored in the long-term memory (LTM) where it can be securely stored as a movement representation that is characteristic of the game (Knapp, 1963). Differences in expert-novice performance pertaining to the organization and use of declarative knowledge during vigorous and continuously changing game situations, have been reported in several open skill sports (Abernethy, 1991; Starkes & Allard, 1993). The memory structures for declarative knowledge are more elaborate and more accessible to the expert player than to the novice (Tenenbaum & Bar-Eli, 1993).

Procedural knowledge is related to the practical aspect of the game. The "How do I do it" question is answered by procedural knowledge. Procedural knowledge is linked to the tactics and strategies of particular game situation (Turner & Martinek, 1994). The expert performer is distinguished by his/her procedural knowledge about "how" to accomplish a goal in a movement situation (Abernethy, 1991).

In a study of soccer expertise among young players, Ripoll & Benguigui (1999) mentioned intelligence as a blend of problem solving, retrieving declarative knowledge from the long-term memory, matching (comparing) the contents of external information to stored information, and the selection of a response that reflects the match found. From this description, it would appear that sport intelligence is the ability to select the kind of skills that are needed and to perform them in an accurate and effective manner. This ability to evaluate the current situation, taking into consideration past related events and prediction of the future outcomes, is essential for making accurate and timely decisions. Within the cognitive context, this clearly defines the challenge in sports performance (French & McPherson, 1999).

Flexibility in processing information may be an additional dimension of sport or game intelligence. Flexibility has been identified as a characteristic of both anticipation and decision-making (Williams, 1985; Nettleton, 1986). Expert players demonstrate high levels of flexibility in their decision-making. This means that they are able to adjust and re-adjust to the consistently changing game environment within a fraction of a second and that the predictions are performed in a seemingly automatic way. This flexibility in anticipation and decision-making is probably based on their knowledge of the game, which has been derived from many years of practice and competition (McMorris, 1999).

PROBLEM

If sport skill development is to be pursued in a systematic manner, sport-specific research must be pursued to identify which variables are crucial for success in a particular sport, or even for a particular position in a sport. Basketball is a high-strategy, open-skill team sport that places an emphasis on a player's ability to make quick and accurate decisions

(Kioumourtzoglou *et al.,* 1998a). By identifying those aspects of decision-making that distinguish the novice from the expert player, practice sessions can be designed that will focus on improving those aspects of decision-making that will accelerate the process of gaining expertise in basketball.

METHOD

While it is important that descriptive and experimental research continues to examine the process of decision-making in sport using traditional paradigms, additional insights may be available using qualitative methods of inquiry. This study was designed to "open the door" on the ideas held by coaches who have spent large parts of their careers trying to improve decision-making and increase levels of expertise in basketball. While it could be expected that their views would be compatible with completed research, their past success in the development of expert players, was seen as an opportunity to gain a unique perspective on decision-making in sport.

The purpose of this study was to conduct an in-depth exploration of the perceptions of elite coaches of the characteristics of decision-making that distinguish elite from novice players in basketball. Six expert coaches were used as the sources of information about the differences between expert and novice players, specifically in basketball. Other studies have drawn insights about expert-novice differences from top-level coaches. Kioumourtzoglou *et al.* (1998a) asked expert coaches to rank those abilities they considered important for excellence in basketball. The expert coaches responded to a questionnaire in which they were provided with definitions and descriptions of a list of abilities found in the literature.

Because qualitative methods of inquiry can be effective when studying unique situations or individuals (Marshall & Rossman, 1989; Kumar, 1996; Marshall & Rossman 1999), it was decided to use the open-ended long interview method (McCracken, 1988) in this study. The long interview can be a powerful instrument for gathering data from experts. Initial questions are structured to gather in-depth information as the researcher probes the mind of the informant(s) to understand the different levels of conceptualizations and perceptions of the issue at hand (Creswell, 1994). In addition to questions that focus on topics drawn from a review of literature, open-ended questions and probes are included to ensure that the informant(s) have the opportunity to express fully their perceptions. The long interview method is not intended to be objective. It is subjective with the intention of gathering the views of the informants on a specific topic with which they have personal experience.

Subjects (informants)

McCracken (1988) recommended that the long interview be conducted with a few informants who are able to give detailed account of their knowledge in a specific area. For the current study, only coaches who had been coaching at the top-level (national and international) for the last five years were eligible to volunteer. Letters of recruitment were sent to all eligible basketball coaches within South Africa. Six informants representing different "basketball backgrounds" volunteered to participate in this study (one coach was originally from Europe, three from the United States, and two from Africa).

Procedure

The initial step in this study was to develop the protocol of questions for the interview. An important characteristic of the long interview is that it is balanced, including open questions that enable informants to express their views, as well as closed questions to direct the informants to focus on key areas (Patton, 1986). The investigators in this study were also expert coaches in basketball. One has coached on the national level and the other on the national and international level. The investigators reviewed the literature on expertise in sport in order to identify the closed questions to be used during the interviews.

The content and structure of the interview protocol was tested for clarity and completeness by taking four university basketball coaches through the protocol. The coaches were invited to assist in the re-phrasing of questions, as well as encouraged to suggest additional questions and probes that they believed would encourage expert coaches to focus on the critical differences between expert and novice basketball players.

All six interviews were conducted by the same investigator. After explaining the study and receiving permission from the informants, a complete audiotape was made of each interview. Shorter more factual questions were asked at the beginning of the interview. Then, as the informant relaxed, more complex questions were asked. The average length of an interview was 87 minutes. The shortest interview was 64 minutes and the longest interview was 110 minutes.

A professional secretary made a verbatim transcript of each interview to facilitate content analysis. This study followed the process for inductive content analysis used by Scanlan *et al.* (1989) in their in-depth study of sources of enjoyment of former elite figure skaters. The method was also used in their complementary study of the sources of stress of former elite figure skaters (Scanlan *et al*., 1991). The purpose of the method is to draw meaning from the transcripts of in-depth interviews, and to validate the product of the research through a process called consensual validation based on mutual agreement (Patton, 1986).

The first step in data reduction was for each of the investigators to review the verbatim transcripts independently. Their task was to identify "quotations" from the informants' comments that were of sufficient length to have meaning. These quotations (phrases) were used at the primary units of analysis in this study. In order to validate the identification of quotations, the two investigators met to discuss their independent efforts to identify quotations. The aim of the discussion was for the investigators to agree (to consensually validate) the collection of quotations as complete expressions of the responses of the informants (Scanlan *et al.*, 1989). The final product of this interaction was a collection of 287 quotations from the six interviews.

The second step in data reduction was to reduce the 287 quotations into "clusters of meaning," each of which had the same conceptual focus. The forming of clusters was done independently by the investigators, followed by a joint discussion where a final group of clusters was determined by consensus.

The third step in data reduction was to reduce the clusters of meaning into more general groupings based on a common theme or topic. The same process of consensual validation was

employed, where the investigators first worked independently to identify the themes, followed by a session in which a joint discussion produced a consensual version of the themes.

The final level of data reduction was to group the themes into general categories of meaning following the process of consensual validation used throughout the study. The product of this process of data reduction was a framework of clusters, themes and categories of meaning that defines what the expert coaches who participated in this study perceived to be the characteristics of decision-making that distinguish expert from novice basketball players.

RESULTS

The results of the data reduction are presented as a framework in Figure 1. Seven clusters of meaning were drawn from the transcripts. These clusters were reduced to four major themes and the themes were grouped into two categories: anticipation and memory.

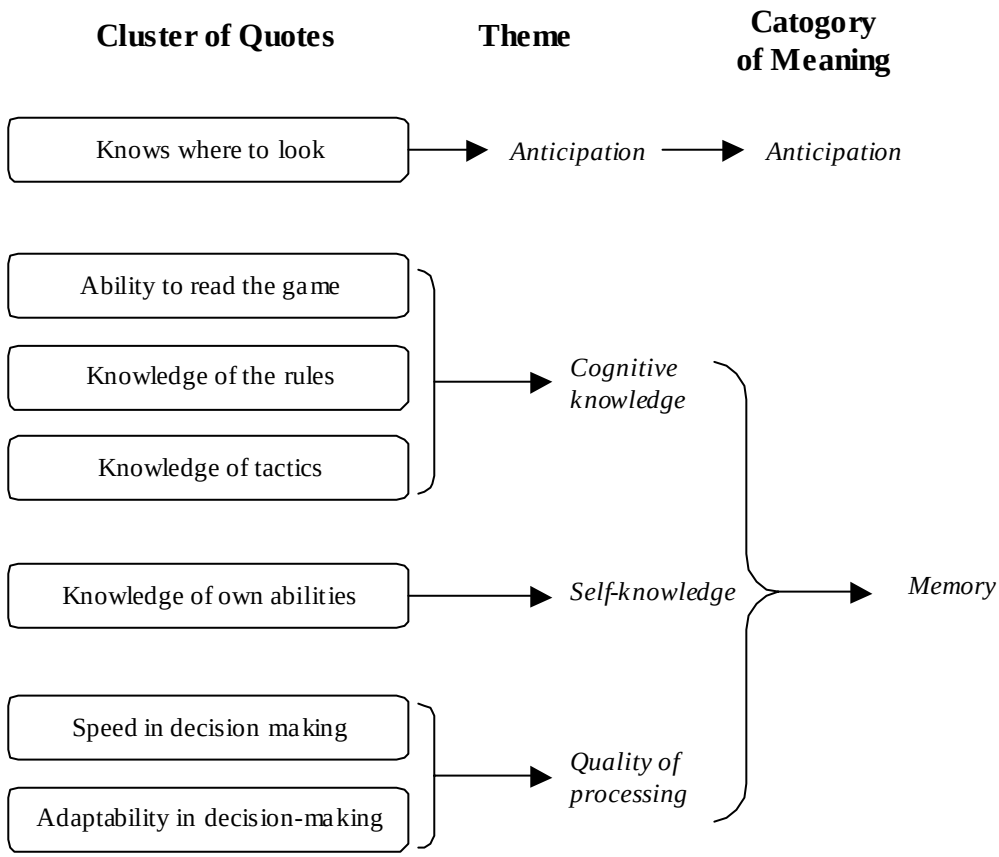

FIGURE 1. **ELITE COACHES' PERCEPTIONS OF THE CHARACTERISTICS OF DECISION-MAKING THAT DISCRIMINATE EXPERT FROM NOVICE BASKETBALL PLAYERS**

Anticipation

It is not surprising that the ability to anticipate what was going to happen in the game was identified as a characteristic that discriminates between expert and novice basketball players. This confirms previous research on anticipation in sport (Williams, 1985; Nettleton, 1986). Anticipation can be regarded as an interaction between attention and knowledge, in which the player quickly picks-up and accurately interprets cues from the environment. Expert ball players are known to use early cues better than novices do (Abernethy & Russell, 1984).

The coaches were convinced that an expert player ***knows where to look***. There is evidence from other research that expert players have acquired specific visual skills and strategies for scanning the playing environment (Starkes *et al*., 1994; Williams & Grant, 1999). Early research on sport vision, for example, established that novice players focus their gaze firmly for longer periods of time and more unsystematically than skilled players (Bard & Fleury, 1976).

Cognitive knowledge

Because French and Thomas (1987) found a significant relationship between knowledge, decision-making and skill in basketball, it is not surprising that the coaches in this study identified several dimensions of knowledge as discriminating characteristics between experts and novices. It can be concluded that experts have a larger, more complex and better organised knowledge base than novices. Although Starkes (1993) noted that experts possess both a large volume of knowledge and a substantial number of procedural skills, a complete determination has not been made of the content of that knowledge base and how that knowledge base is developed (Thomas *et al.*, 1993).

The coaches in this study were convinced that one characteristic of the expert player was the ability to use his/her knowledge base. They specified that the expert has a superior ***ability to read the game***. In coaching terms, "reading the game" includes an understanding of what is happening as well as what is about to happen. Rothstein (1985) reported that skilled athletes can perceive more information in one glance, because they tend to recognize patterns and not individual stimuli. This conclusion relates to experts' ability to chunk information based on their superior knowledge structure about their sport. Expert players perceive patterns of information and not individual stimuli. This means that their decision-making processes are guided by rules. It has been stated that rules enable the efficient use of the early cues for quick recognition and the retrieval of relevant information in the long term memory (Ripoll, 1991; Tenenbaum & Bar-Eli, 1993; Kioumourtzoglou *et al*., 1998a).

Although knowledge of rules and knowledge of tactics can both be considered forms of declarative knowledge, knowledge of tactics and strategy has been linked to procedural knowledge (Turner & Martinek, 1994). Apparently a player must understand tactics in order to plan and implement effective motor responses in a game situation. The coaches interviewed in this study were convinced that the expert has a much greater cognitive understanding of basketball than the novice player. They referred specifically to a more elaborate knowledge of the rules of basketball as well as a more sophisticated knowledge of tactics as discriminating characteristics of experts. The expert, it appears, had an integrative cognitive ability that allows them to constently make better decisions in complex situations (Tenenbaum & Bar-Eli, 1993).

Self-knowledge

The coaches in this study also described the expert player as one who would play within his/her abilities. This was not to suggest that experts are in any way modest or self-critical, but rather that they are aware of their skill, fitness and potential, and are able to make their decisions within the context of what they are capable of doing in specific situations. Certainly self-knowledge is a product of automation of skills. The concept of "tuning" has been associated with knowledge generalisation, a process in which the rules for applying knowledge are tested and sorted so that more accurate rules to guide decision-making are developed (Helsen & Pauwels, 1993; Turner & Martinek, 1994). Perhaps something like "knowledge personalisation" occurs at the higher levels of skill development as the player becomes an "agent" who can help dictate the pattern and pace of a game.

Quality of processing

There is evidence that the ability to efficiently process information from the environment is one of the critical skills of expert performers (Williams *et al*., 1992). Experts have been found to have a greater capability to check, encode and retrieve the structural (strategic) aspects of ball-sports (Allard & Burnett, 1985). The coaches in this study were specific that experts and novices were quite different in terms of what they called ***speed in decision-making***. They considered experts to be substantially faster than beginners on every dimension of performance – perception, decision-making and skill execution. Gardner and Sherman (1995) identified the speed of processing as one feature that distinguished winners from losers in a competition. Recent research has supported the idea that expert basketball players are superior in recall ability for basketball situations, including superior speed in perception, efficiency in recall of past situations, and interpretation of patterns presented to them (Kioumourtzoglou *et al.,* 1998a; Kioumourtzoglou *et al.,* 1998b).

An additional characteristic of information processing was the ***adaptability in decision-making*** that the coaches described as a characteristic of expert players. Adaptability means that expert players are able to adjust and re-adjust to the consistently changing game environment. Experts demonstrate high levels of flexibility in decision-making under complex decision-making game situations (McPherson, 1999). This attribute has also been described as "flexibility in decision-making," and is based on cognitive knowledge about the game that has been derived from many years of practice and competition (McMorris, 1999).

CONCLUSION

Anticipation, recall and memory are considered central in the processing of decision–making during game situations. They are identified as the foundation of "sport intelligence" and are sources of expert-novice differences in sport performance (Chase & Simon, 1973; Starkes, 1987; Tenenbaum & Bar–Eli, 1993; Wrisberg, 1993; Ericsson & Charness, 1994, McPherson, 2000). Of particular interest to this study are the reported expert-novice recall differences in basketball (Allard *et al*., 1980; Allard, 1982; Allard & Burnett, 1985; French & Thomas, 1987; Allard *et al*., 1993; Kioumourtzoglou *et al*., 1998a; Kioumourtzoglou *et al*., 1998b). These results have demonstrated that expert basketball performers are superior in speed of perception, efficiency in retrieval of information and interpretation of incoming cues to create meaningful information patterns.

Studies on expert-novice differences have been pursued to establish the possible locus of expertise in high strategic sports performance. Expertise is surrounded by the task-specific individual differences in perceptual and cognitive abilities. In both components of performance, the organization and interaction of declarative knowledge and procedural knowledge on one hand, and the interaction with the ecological information on the other hand, is a critical determinant of who is an expert in a specific sport.

It is hoped that this research will encourage sport scientists to use expert coaches as sources of knowledge about sport. Their perceptions about the nature of expertise is a promising direction for qualitative inquiry in sport science. The expert coaches interviewed in this study have perceptions about expert-novice differences that are consistent with the findings of past descriptive and experimental research. This is encouraging for both coaches and sport scientists, since it indicates that there may be a rich opportunity to bridge the theory-practice gap regarding decision-making in sport, based on shared assumptions about the nature of cognitive processing. The coaches' identification of self-knowledge as a characteristic of experts should encourage sport scientists to broaden their focus on declarative and procedural knowledge to include the personal or existential knowledge.

The framework generated in this study also could be used to guide the design of practice sessions and periodisation of training for basketball. According to the coaches in this study, anticipation, knowledge of rules and knowledge of tactics are central to expertise, and adaptability as well as speed in making decisions are required at the higher levels of the game. For example, players need to be taught how to read the game. The "games sense" approach to teaching sport skills is compatible with these characteristics and may be a preferred method for developing skillful performers on the advanced as well as the beginning levels.

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