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Tacit Knowledge in Expert Coaching: Science or Art?

Christine Nash and Dave Collins

Effective coaching is a mixture of pedagogy and principles of sciences, e.g., motor skill acquisition, sociology, and physiology, often referred to as the science of coaching. Instinctive or intuitive coaching has often been incorrectly viewed as the art of coaching. More important should be how coaches develop knowledge, how they access that knowledge at the appropriate times and how this affects their decision-making process. The study of expert coaches should allow inferences to be drawn from their development and applied to coach education. This article intends to clarify coaching expertise and examine the role of tacit knowledge within coaching. The lack of a clear development pathway for aspiring expert coaches is a clear indicator that the current coach education system needs review. Any effective education system should be based on knowledge and understanding rather than mimicry and the implications for the future of coach education are considered.

It is the last few minutes of Germany versus Poland in the 2006 World Cup and the host nation, Germany, is heading for a disappointing draw. Jurgen Klinsmann, the German coach, halts the game by making a substitution, after which Germany scores, winning an important group game. Now the question arises: How did the coach make exactly the right decision at the crucial moment? If this wasn't just "luck" and this seems highly unlikely, what was it? Intuition? Instinct? Whatever it was, it must have been based on some factors or knowledge, which he had built up during his extensive coaching experience. How did he access this information that he obviously had stored?

The coach has been called a "master of the instantaneous response" (Launder, 1993, p. 2) and this has led to debate as to whether coaching is an art or a science (Launder, 1993; Woodman, 1993; Lyle, 1999). The dissemination of information regarding refinement or development of physical performance has been traditionally regarded as a science, e.g., training techniques, improvement of specific aspects of fitness, and psychological preparation. Some coaches have encouraged the notion of coaching as an art form, where decisions are made as a result of "gut feeling." Other coaches operate completely instinctively, approaching coaching as an apparent art form. These coaches are unable to articulate why they make decisions, how they structure feedback, and the place of experience and knowledge within this

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process. This reflects tacit knowledge, which can be abstract and unarticulated, the type of knowledge, which is routinely used and taken for granted (Sternberg & Horvath, 1999).

In this article, the literature surrounding expertise and expert studies is examined, specifically as it relates to sport coaching. The role of tacit knowledge within expertise, particularly within the time-constrained coaching context, is evaluated in relation to the learning and development of coaches. Common assumptions are that coaching is instinctive and does not need to be learned, coaches are hired because of their performance as an elite athlete, having little knowledge of coaching principles and that anyone can coach. If quality coaching and guidance are cornerstones in the development of sport, it is vital to educate coaches using methods that they feel are useful and successful. This article concludes with the implications for coach education and development.

What is Expert Coaching?

A number of propositions have been made regarding expertise and tested in a variety of contexts e.g., chess, music, clinical diagnosis, and sport. Similar trends/themes have emerged across these divergent disciplines concerning the nature of expertise, which include:

- Expertise is domain specific and developed over a prolonged period of time;
- Experts recognize patterns faster than novices;
- Expert knowledge is structured to allow easier recall;
- Experts sort problems into categories according to features of their solutions;
- Experts initially are slower to solve problems than non-experts but are faster overall;
- Experts are more flexible and are more able to adapt to situations;
- Experts develop routines to allow processing capacity to be focused on ongoing environments; and
- Experts take deeper meanings from cues than novices.

(Glaser, 1990; Berliner, 1994; Guest et al.; 2001, Kreber, 2002).

Quality coaching has now been recognized as one of the key aspects in both player and team development but the role of the coach is very diverse and often not fully understood. The coach may be involved in a myriad of distinct tasks but the basic role is to develop and improve the performance of teams and individuals. The coach has to organize practice sessions, develop techniques, skills, and tactics for competition, ensure optimal physical preparation, and guide the performer or team throughout the season. To do this effectively, the coach must use many different types of knowledge to solve problems and ultimately make decisions.

Decision making has been identified as one of the key functions that define a coach but surely the "hallmark" of an expert coach is not merely making decisions but making correct decisions. The questions which then have to be asked are how does a coach develop decision-making skills and when these skills are developed does the subsequent decision making then appear spontaneous? In other disciplines,

there is a tendency for experts to approach problems in a different manner from novices, with studies of medical expertise finding a strong correlation between forward reasoning and accuracy of decision making (Patel & Ramoni, 1997). When solving a problem, the individual will look for the easiest solution, the one that involves the least challenge on cognitive resources, using demanding problem-solving strategies only when there is no other option (Anderson & Leinhardt, 2002). Generally, the first step used by people familiar with the situation will be the retrieval of a known solution from long-term memory. If it is not possible to retrieve this solution, then the individual will access a set of cognitive rules regarding the decision (Vanlehn, 1996). These cognitive rules, or principles, are applied more by experts than novices (Marshall, 2002). Expert problem solvers tend to work forward from the given information to the decision while the less expert tend to work backwards, eliminating various hypotheses by trial and error (Patel et al., 1997). Improved decision-making capability can allow decisions to be made more quickly, often allowing experts to appear intuitive.

Within the artistic field, there is little agreement on the determinants of true expertise in literature, music, and acting (Ericsson, 1998; Sloboda, 1996; Hagen, 1991). Many of these initial expert/novice studies were carried out using areas with a defined structure, where there was a right and wrong answer, e.g., computer programming, physics, and chess. It would seem that it would be easier to define an expert within these fields rather than in ill-structured, constantly changing environments where speed is of the essence, e.g., teaching and coaching (Berliner, 1994; Krishna & Morgan, 2002). More recent research has suggested that there are two different classifications of expert, routine and adaptive, indicating that those designated as expert in a rote task may not be as skilled as those who adapt to changing or dynamic situations (Barnett & Koslowski, 2002; Guest et al., 2001).

An area of significant research activity has been that of observation of coaching behavior, usually during practice sessions (Lacy & Darst, 1985; Claxton, 1988; Douge & Hastie, 1993; Franks, Johnson, & Sinclair, 1988) While this has elicited valuable information, it does not encompass the entirety or complexity of the coaching task, neither does it offer any insight as to why these behaviors occurred. Much of this research has been superficial and mostly related to the direct intervention/session delivery skills necessary in coaching. This again correlates with existing research within teaching, especially physical education teaching (Griffey & Housner, 1991).

More recently, research has focused on the knowledge of experienced coaches, using a mixture of questionnaires, in-depth interviews, and protocol analysis (Cote, Salmela, Trudel, Baria & Russell, 1995; Jones, Housner & Kornspan, 1995; McPherson, 1993). This type of research still does not have the capacity to capture the dynamic nature of the coaching situation as it tends to focus on one particular aspect, i.e., communication, planning skills, feedback (Chelladurai & Quek, 1996; Claxton, 1988; Jones et al., 1995; McPherson, 2000; Bloom, Schinke & Salmela, 1998). Many of these studies have used similar criteria to define expert coaches, e.g., coaching national teams, numbers of years accumulated experience, and development of elite performers (Gilbert & Trudel, 1999; Cote et al., 1995; McPherson, 2000).

The basis for defining coaching (and therefore the job of the coach) must start with the recognition of the various components of that role. Before coaches can

be evaluated and designated as expert or otherwise, all dimensions of their performance must be appraised, not merely success (MacLean & Chelladurai, 1995). Experts have been defined by these observation instruments giving a quantitative measure of their behavior in practice and competition environments (Franks, 1986; Chelladurai & Quek, 1996). Frustration with behavioral approaches to assessing coaches led Jones, Housner, and Kornspan (1995) to state "it is imperative that direct observation techniques be supplemented by methods for exploring the thought processes of coaches" (p. 203) as these techniques do not address the enormity of the coaching role. Coaches may be viewed as a manager of the coaching process, a technical advisor, a tactician, and a teacher. Many other variables affect the implementation of the coaching process: team or individual sport, age of performer, ability of performer, coaching philosophy, understanding of the coaching process, coaching environment, and level of effectiveness. This may indicate that the expert coach is someone who can make appropriate decisions within the constraints of their coaching practice, reinforcing the belief that coaching is a cognitive activity (Lyle, 1999).

If the task of coaching is to progress, expert knowledge and its development needs to be better understood and more importantly, applied. In a knowledge-based subject area, education and training to develop skill and expertise is important. However, there may be difficulties in using these same experts to raise the knowledge levels in both teaching and coaching as the very components of expertise preclude experts from passing on their skills (Hinds, Patterson & Pfeffer, 2001). This would support the view that a coach who was completely instinctive would not be the most effective at developing novice coaches, as these "intuitive experts" cannot explain their decision-making processes. Many coaches learn through a series of apprenticeships, working with more experienced coaches. This would be in addition to formal coach education courses that are required. Much of the knowledge growth experienced in this type of environment can be slow as is the case with conceptual change, which is a social as well as cognitive process (Vosniadou & Kollias, 2003).

In teaching three separate types of knowledge regarding teaching have been identified—instructional, pedagogical, and curricular, which would apply to PE teaching as well as classroom teaching (Kreber & Cranton, 2000). In PE, teachers are assumed to have declarative knowledge regarding exercise, sport, and human movement, as well as procedural knowledge on teaching and learning methods (Ennis, Mueller & Zhu, 1991). Experienced teachers are more concerned with managing activities during instruction and providing students with information that would facilitate motor skill acquisition, e.g., assessment, feedback, demonstrating and focusing student attention on critical aspects of the skill (Griffey & Housner, 1991). The less experienced teachers tend to try to control activities more closely, perhaps due to a lack of confidence and familiarity with the environment.

Coaches would be expected to have similar declarative knowledge about the specifics of their sport: tactics, training techniques as well as similar procedural knowledge regarding the pedagogical process (see Figure 1). Coaches must also make use of the "ologies," i.e., psychology, physiology, kinesiology, and sociology to improve the performance of their athletes. Again, this model seems to suggest that coaching knowledge "appears" to be a result of these three types of knowledge. It does not, however, address the process of how these separate areas of knowledge

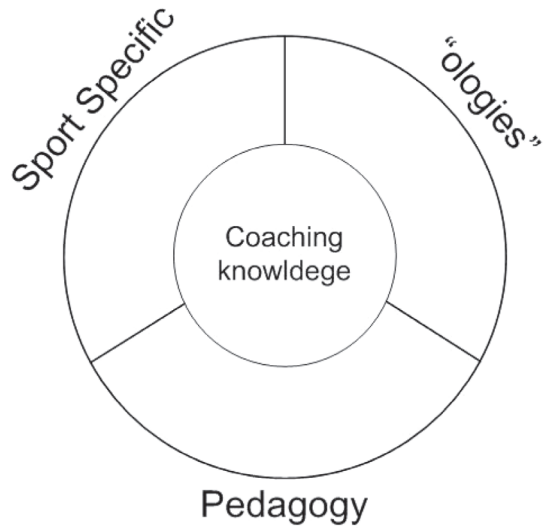

Figure 1—Proposed knowledge systems in coaching. Adapted from Kreber & Cranton, 1997.

interact to develop domain-specific knowledge in coaching. This could also be explained by conditional knowledge, meaning the knowledge of when to use both declarative and procedural knowledge.

In a study comparing expertise in both coaching and PE teaching, the indications were that expert coaches do not generally exhibit the same pedagogical characteristics in their teaching role as their coaching role (Hardin & Bennett, 2002). This is worthy of note as the subjects in this study were PE teachers who were also coaches, perhaps indicating that their approach changed with the purpose. This could relate to their knowledge base, which is of importance, but judgments on expert status are made on how knowledge is used in practice, rather than knowledge alone (Kreber, 2002). Perhaps the influence of the different roles, PE teacher and coach, would have an effect on the emphasis of the knowledge base. There are also considerable differences in the training times for PE teachers and coaches, which could account for differences in the knowledge base.

Tacit Knowledge

"The experts can't tell you how he does what he does" and on the surface this seems to infer that the decision making is instinctive and the coach is operating tacitly (Vickers, Livingston, Umeris, Bohnert & Holden, 1999, p. 28). The classic examples of expert pattern recognition came from experiments carried out using chess masters and novices, with the conclusion being that experts can not only recall larger patterns of chess pieces but more of them than those who are less expert (Chase & Simon, 1973). This points to highly developed procedural

knowledge of these patterns, with little or no need for recall of declarative information of why these patterns occur, which may interfere with working memory. Chess, however, is a highly structured domain, especially when compared to the ill-structured domains of coaching and teaching, although it has been suggested that similar distinctions are observable in novice/experts studies in less structured domains (Berliner, 1994).

Tacit knowledge has been used to characterize the knowledge gained from everyday experience that has an implicit, unarticulated quality (Sternberg, 2003). It has been referred to in various forms: implicit knowledge, practical intelligence, working knowledge, and it could be the type of knowledge that coaches use in competitive situations (Vereijken & Whiting, 1990; Wood, Bandura & Bailey, 1990). Tacit knowledge is often not openly expressed or stated therefore individuals must acquire such knowledge through their own experiences. Polanyi (1983, 1974) pioneered work in this area, recognizing the importance of first hand experience during training, e.g., student teacher training; furthermore, he also theorized that more complex skills could not be taught through traditional methods.

As expertise increases, these mental representations become more abstract, suggesting that experts process information in a more intangible manner (Gobet & Simon, 1998; Hinds et al., 2001). Novices frequently concentrate on irrelevant information when making decisions. It has been suggested that increasing declarative knowledge will increase the learners' ability to determine the most appropriate information, thus improving their effectiveness (Bromme, Rambow & Nückles, 2001). This ability to access different types of information quickly demonstrates that fundamental analysis may play a part in expert induction (Shafto & Coley, 2003). Experts draw on a well-developed repertoire of knowledge in responding to problems in their respective domains, e.g., the sports coach will require knowledge in many areas: tactics, skills, communication, practice organization, management, and development. This knowledge would tend to be procedural in nature and the coach is said to respond to the particular situation in an instinctive manner (Sternberg, 2003).

Although people's actions may reflect their knowledge, they may find it difficult to articulate what they know and this contributes to the mystery surrounding tacit knowledge. As coaches develop expertise, the process appears to become less well-defined, perhaps because these coaches are not aware of the reasons behind their decision making. "Therefore, as expertise grows, greater reliance is placed on intuitive feeling to guide performance." (Davids & Myer, 1990, p. 275). So, is tacit knowledge of benefit to coaching and coach education? Does it help to explain the seemingly instinctive actions of expert coaches? Many coaches do appear unable to explain their actions, especially while under competitive stress, but reflection and experience can allow them to express their thought processes using, for example, "think aloud" processes or stimulated recall using video (McPherson, 2000; Ghaye, 2005). This is not universally supported as opponents of the practice believe that creativity cannot be practiced (Sternberg, 1996). This supports the view that tacit or intuitive action cannot be conceptualized or taught, again reinforcing the notion of reflex action.

Tacit knowledge is knowledge gained primarily from experience performing practical, everyday problems. This relationship is built largely by the direct effect of experience on the acquisition of job knowledge and generally increases with

experience. It has been assumed that knowledge is transferable but as tacit knowledge is considered to be unconscious, is this still the case? Some coaches are very good at introducing the game to developing athletes but cannot coach performance athletes. A link has been identified between the instructional styles of classroom teachers and their tacit knowledge of their childhood play, which assists them in understanding their pupils (Witte, Everett-Turner & Sawada, 1991). This suggests that coaches may be better able to interact with athletes if they were performers in that sport.

Coaches have often attempted to put themselves in the athletes' shoes or related to their own memories as an athlete to understand behavior "from within." The expert coach's understanding of these "professional" sport conditions depends simultaneously on two forms of knowledge. First, general or specific structured knowledge that depicts the events experienced in the coaching environment and is based on rational thinking, whether controlled or automatic. Second, personal and contextual knowledge generated in the form of an immediate understanding of the situations, which grants meaning to the actions and events experienced without the need for reference to a deductive and causal framework (Saury & Durand, 1998). Certain distinctive cues appear to link current situations to past experiences, which may explain the coach's seemingly instinctive decision making.

Along with this specific knowledge, the on-the-job experience of coaches appears to be one of the main sources of their expertise. As with expert teachers, coaches may form contextualized procedures of problem solving and organizational acts allowing complex situations to become more manageable. The coach would appear to act appropriately, not necessarily on the basis of deductive reasoning and rational thinking, but by having dealt with similar situations in the past and recalling solutions to enable an apparently intuitive remedy. Many coaches have admitted to learning some difficult lessons by using a trial and error approach and generally, this approach is not encouraged (Bloom, Stevens & Wickwire, 2003). Tacit knowledge can be developed using a problem-solving approach, so should this be considered as an integral part of coach education provision?

As mentioned previously, experts in both ill-structured and well-structured domains rely on integrative, conceptual representations that subsume the surface level features that novices focus on (Zeitz, 1997). Using these concepts allow experts to display superior performance in domain-specific memory tasks where they remember the abstract rather than the detail. It has also been proposed that they allow the transfer of knowledge by providing a link between specific problem situations and the more general knowledge base the expert has accumulated through experience (Ericsson & Lehmann, 1996). Experts have more knowledge within their particular domain than novices or the less expert, suggesting that expertise is hierarchical (Hinds et al., 2001). This means that expert coaches must have an extensive foundation of declarative knowledge before they can start to function in this more abstract or intuitive manner: "domain specific knowledge, as opposed to general cognitive strategies, were responsible for higher-order processing and performance" (McPherson & Kernodle, 2002, p. 141). This would suggest that more time should be spent developing knowledge bases within disciplines, including coaching. The most successful way of accomplishing this, according to experienced coaches, is to learn from successful coaches (Gould, Guinan, Greenleaf & Chung, 2002).

Summary

Prior to discussing the implications, it would be helpful to highlight the key points. Coaching is a very complex and dynamic task, carried out in an ill-structured, constantly changing environment. The expert coach can operate effectively within this context, making decisions, solving problems, and operating on an automatic level. Many of the coach's actions appear instinctive but are actually based on a complex interaction of knowledge and memory of similar situations, honed by years of experience and reflection (Schon, 1987). Expertise can be defined as "a fluid configuration of knowledge, information and situated experience, all of which are apt to change in response to questions arising in highly specific and localized contexts" (Nowotny, 2000, p. 12). This demonstrates the diverse nature of coaching but also implies that not all coaches, no matter how long they remain in sport, can become experts. More knowledgeable coaches, who are able to conduct programs effectively, would enrich sport and the development of elite performers.

Implications

These are twofold and may be considered separately: (1) the implications for coach education; and (2) the implications for the development of expert coaches.

Coach Education

Coach education has to move away from the traditional classroom approach, embracing more interactive methods. Research has shown the importance of problem solving and decision making, neither of which can be taught or learned in traditional manners. This has implications for the training of teachers and coaches, specifically for those recruited as educators. Research has shown that as a result of the abstract concepts used by experts as routine, those less expert have better results instructing novices (Hinds et al., 2001).

A number of researchers postulated that the type of cognitive processes sports performers would use during competition would be linked to their knowledge base of the task at hand (McPherson, 2000). Do the cognitive processes of coaches link to their knowledge base? This demonstrates the importance of critical or reflective thinking in coaches' development, initially the practice of questioning previous coaching behavior (Strean, Senecal, Howlett & Burgess, 1997). This would necessitate much effort on the part of the coach, as "…higher levels of expertise attained require roughly an order of magnitude of more time and effort than that of the next lower level" (Singer, 2002, p. 362).

Recent research has revealed that athletes advance through four distinct stages on the route to expert performance: sampling, specializing, investment, and maintenance (Durand-Bush & Salmela, 2002). As outlined by Cote et al's model (1995), athlete development is multi-dimensional by nature; therefore, coaches' knowledge across many domains would be beneficial to their performers. This knowledge should be reflected in course content within coach education programs (Haslam, 1990). Current research has demonstrated that many coaches do not perceive their coach education courses delivering the type of information that they can use to improve their athletes, e.g., not sport specific, delivery is not

always as prescribed, assessments are performed by rote (Campbell, 1993; Douge & Hastie, 1993; Siedentop & Tannehill, 2000). It has also been suggested that the available coach education courses are presented and assessed in a format that does not encourage learning to take place (Gilbert & Trudel, 1999; Australian Sports Commission, 1994; Haslam, 1990; Abraham & Collins, 1998). Many coaches attribute their development of coaching knowledge to their own experience and observing experienced coaches (Gould, Guinan, Greenleaf & Chung, 2002; Cushion, Armour & Jones, 2003).

The needs and aspirations of coaches are generally neglected in the design of courses, further illustrating that evaluation of coach education programs has become one of the most pressing issues in sport science research. If quality coaching and guidance are cornerstones in the development of sport, it is vital to educate coaches by using methods that they feel are useful and effective. It could be inferred that the more expert the coach, the more likely they are to improve athletic performance. Research suggests that the expert teacher with 10 years experience will have spent a minimum of 10,000 hours in the classroom as a teacher, preceded by about 15,000 hours in the classroom as a student (Berliner, 1994). It is yet unknown whether the latter experience is of any value but it does tie in well with the myth that an expert coach must have been a top player—this needs further investigation. If coach education is fundamentally restructured and follows the same pattern as teacher education, it would still only provide approximately 4,000 hours of training—still considerably less than the minimum suggested for expertise.

Development of Expert Coaches

The earlier diagram (Figure 1) proposed that there were three components of coaching knowledge, yet it did not address how this knowledge was gained or, more importantly, how the components interact. Development models are often displayed in a hierarchical structure, suggesting that knowledge development is merely a cumulative function. If Figure 1 is unrolled to form Figure 2, it certainly follows that there is a hierarchical structure but it is proposed that coaches must build a solid base in all of these areas. Coaches must also gain experience in applying this knowledge within their varied coaching environments. However, many coaches gain knowledge and experience within their sport but still do not

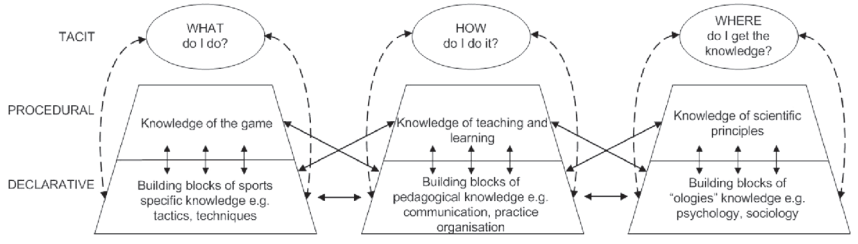

Figure 2—Interaction model of coaching knowledge.

display the automaticity associated with tacit knowledge. There are other coaches who appear to be completely tacit, always operating in an intuitive or instinctive manner. Instead of this knowledge necessarily developing hierarchically over a period of time, it is proposed that the currency of transfer is the base of declarative knowledge and the linking and interacting of information at this base level in order to make appropriate decisions.

In the design of coach education courses, much more time should be allocated to developing this procedural knowledge base, which coaches require to improve their athletes. The question of coach educators requires more careful consideration. There would appear to be three main categories into which coaches fall: tacit, automatic, and parrots. Those who are completely tacit would not be effective as coach educators for the same reasons as parrots: i.e., they cannot explain why they make their decisions, albeit for different reasons. Unfortunately, many of the existing coach education courses develop parrots, as the evaluation criteria require mimicry of the course tutor, without any recourse to independent thought. If expertise in coaching is to be developed, then this must change to allow and encourage coaches to ask why. It would then follow that the knowledge base of the coach must be sufficiently enlarged to enable them to work out the answers, i.e., enhance their reflection and problem-solving skills. Some sporting environments may more readily encourage this approach than others. Unless coach education can change fundamentally, enabling coaches and coach educators to embrace all the elements of coaching, the old system where coaches succeed through luck will continue.

Those coaches, who are sufficiently developed to display automaticity in their coaching, should be targeted to become coach educators. They display attributes associated with expertise in their domain, combined with sufficient practice in their field. A mixture of reflection and mentoring can develop these attributes, which allows the coach to synthesize all the different information necessary to be called an expert coach. It is also imperative that the notions of continuing development or "lifelong learning" become more accepted within sport coaching.

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