EFFECTIVE COACHING AND FACTORS CONTRIBUTING TO HIGH PERFORMANCE IN GYMNASTICS

By

KATARINA NORDBECK

A THESIS SUBMITTED IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE DEGREE OF

BACHELOR OF INTERDISCIPLINARY STUDIES

THOMPSON RIVERS UNIVERSITY

We accept this thesis as conforming to the required standards:

_____

Anne Terwiel, Thesis Supervisor, Dept. Tourism Management

_____

Dave Freeze, Dept. Adventure Tourism

_____

Peter Soberlak, Dept. Physical Education

_____

Mark Rowell Wallin (Ph.D.), Co-ordinator, Interdisciplinary Studies

Dated this 10th day of May, 2013, in Kamloops, British Columbia, Canada

ABSTRACT

Sport performance is dependent on both genetics and the environment and is affected by the athletes mind and body. The purpose of coaching is to improve the physical and mental aspects in an athlete and to prepare them for competition. Totally planned systems are among the top five characteristics of effective coaching; nonetheless, it is less likely that expert, gymnastic coaches have a ready-made schema that contains a generic knowledge base. The most likely factor for expert performance is the engagement in deliberate and sustained practice over numerous years but there are only a limited number of ways to create large improvements in performance. Every sport-specific event requires its own set and combination of traits and factors.

This aim of this paper is threefold, first to have a better look at effective coaching and the development of expert coaches; second, to explore the gap between existing coaching practices by expert gymnastic coaches; and third, have a broad look at factors that can contribute to expert performance in gymnastics.

Thesis Supervisor: Anne Terwiel

TABLE OF CONTENTS

Mark Wa
Deleted
Mark Wa
Deleted:

INTRODUCTION

The purpose of this paper is to review the current literature with regards to effective coaching and factors contributing to high performance in sport. Since the area of sports is only a general term, this paper's focus will be on gymnastics.

Sport performance has been interdisciplinary from the start and explores the mind-body connections and factors that affect the outcomes in a sport situation (Aoyagi, Portenga, Poczwardowski, Cohne, Statler, 2011). While some claim that there is only a limited number of ways to improve performance (Ericsson & Charness, 1994), optimal performance and sport expertise is dependent on many factors, whose primary influences are genetics and the environment (Baker & Horton, 2004; Ericsson & Charness, 1994; Reilly, Morris, Whyte, 2009). Genetics can influence performance through preferred activity level and individual temperament of the athlete (Ericsson & Charness, 1994). The environment can have an affect in the sense that engagement in deliberated and sustained practice over numerous years will increase the likelihood for peak performance (Ericsson & Chamess, 1994) (Baker & Horton, 2004). Aspects that are due to a combination of both genetics and environment are considered to be psychological factors. These factors include: common mental characteristics, motivational factors, focus, management of anxiety, concentration, risk-taking, and competitiveness. The level of performance does not depend on any one factor but rather lies within the different relationship between variables and the outcome, and is thereby limited by uncertainty (Baker & Horton, 2004).

The purpose of coaching is to improve the physical, mental and emotional aspects in an athlete and to prepare them for competition (Dorgo, 2009). Dowdell (2010) suggests that totally planned systems are among the top five characteristics of effective coaching. This concept of totally planned systems is interesting when compared with the findings that Cote, Samela & Russell (1995) present in their article regarding the knowledge of high-performance gymnastic coaches. This article says that the most important knowledge sources for expert gymnastic coaches are their own experience and other successful coaches and that they are less likely to have a ready-made schema that contains a generic knowledge base.

This aim of this paper is threefold, first to have a better look at effective coaching and the development of expert coaches; second, to explore the gap between existing coaching practices by expert gymnastic coaches that are presented by Cote, Samela & Russel (1995) in contrast to what the current literature says about effective coaching; and third, have a broad look at factors that can contribute to expert performance in gymnastics.

EFFECTIVE COACHING

A coach is an essential part of the development of an athlete's performance. In sport science there has been more focus on the performers and on effective and expert coaching than on the development of coaches from the novice stage to expert. Research shows that by only attending a coaching course coaches rarely improve their overall effectiveness, but significantly improve their coaching self-perception That is, a coaches' belief in their own ability is increased rather than their actual effectiveness viewed from

an objective standpoint (Nash & Sproule, 2011).

MacDonald, Cote & Deakin (2010) write that athletes express increased self-esteem and a more positive evaluation of their coach if their coach has received a formal coaching education when compared to no education at all, although formal coach-training (e.g. certification program) is not the only effective method to increase the coach's knowledge. In sport and coaching today, mentorship (the system were novice and beginners learn from more experienced coaches) is still common (Nash & Sproule, 2011). Knowledge achieved informally through interactions with mentors can help facilitate the transfer of knowledge of the novice coach into applied coaching practices (MacDonald, Cote & Deakin, 2010). However, in their article MacDonald, Cote & Deakin, (2010) do not differentiate between formal and informal training of coaches and they also do not indicate which form produces the best result. Nevertheless, they do suggest that any training or education that the coach receives is better than none.

Another side of the development of effective coaching is the experiential knowledge of elite coaches. Experiential knowledge is based on the coach's many years of practice and her or his experiences gained from coaching different athletes. Expert coaches have different levels of exposure to certain levels of training and sport research, both through formal and informal education. This difference in levels of knowledge and the application thereof can affect the performance of their own coaching and thus affect their athlete's performance. To create a clearer picture of expert performance, it is important to integrate the expert coach's knowledge with current scientific research to provide a clearer picture of effective and expert coaching within that particular sport (Greenwood, Davids, & Renshaw, 2012). To develop expertise, a coach must

independently use all their sources in their coaching (Nash & Sproule, 2011).

The conclusion that can be elicited about effective coaching is that attending coaching courses rarely improves the overall coaching effectiveness but increases the coaches' self-perception about their own coaching abilities. However, experiential knowledge as well as coaching education (both formal and informal) is important for expert coaching and a positive athlete response. Is the assumption then that coaching courses are important but not as a single source of knowledge? Or is the importance of a coaching course due to the content of the courses presented? Many questions arise from these articles about effective coaching and how to develop expert coaching. A question that surfaces is with regards to what impact this has on small sport clubs and smaller cities with only a limited numbers of active coaches within that sport. Coaching courses can be expensive and therefore may not be an option for a volunteer coach. Additionally, without any expert coaches available to mentor the novice coaches, it can be hard to increase the level of performance of the club's athletes. The notion of mentorship is dependent on the availability and the ability of the expert coach to pass on her or his knowledge in such a way that it increase the understanding and learning from the novice coach. The literature has yet to offer a clear solution as to how we develop effective coaching and expert coaches, especially in these situations mentioned above where the lack of important resources such as mentors and funding for courses are a present issue.

KNOWLEDGE OF EXPERT GYMNASTICS COACHES

As mentioned in the previous section of this paper, Cote, Samela & Russell (1995) observe that the most important knowledge sources for expert gymnastics coaches

are their own experience and that of other successful coaches. Their study also showed that it is unlikely that gymnastics coaches have a ready-made schema that contains a generic knowledge-base necessary to develop elite gymnasts; rather, the coaches produce a new and unique estimation for each single gymnast (Cote, Samela & Russell, 1995).

Dowdell (2010) lists attributions of effective gymnastic coaching and mentions that this list both confirms past studies and provides a more comprehensive view by adding some key learned practices. Concepts of effective coaching are, when ranked by attributes: planning, effective and competent teaching, sport specific knowledge, goal setting, implementation, good inter-personal communication, knowledge and use of good physical environment, good technical understanding, and last, "spotting" (Dowdell, 2010).

Dowdell (2010) additionally proposes that this list corresponds with current literature and survey findings that suggest totally planned systems, sport specific knowledge, and maximization of the instructional process are among the top five characteristics of effective coaching. Outcomes that stress more of the social-psychological interactions among coach, student and class are all aspects of learned practice that cannot be accomplished outside the world of practitioner experience (Dowdell, 2010).

These findings by Dowdell (2010) as well as those by Cote, Samela & Russell (1995) show an interesting gap and inconsistency between effective coaching and current expert coaching in the field of gymnastics. Totally planned systems are, in Dowdells (2010) report, essential for effective coaching, yet expert gymnastic coaches in the study

by Cote, Samela & Russell (1995) are not likely to have a generic plan on which to base their coaching.

Cote & Samela (1996) further support this contradicting gap in expert gymnastic coaching by highlighting the importance of organizational tasks for success in gymnastics. They mention that coaches must possess high levels of organizational skills to coordinate the various variables involved within the process of developing elite athletes. By interviewing expert gymnastic coaches and analyzing their answers, Cote & Samela conclude that 24% of important coaching factors are represented by an organization component. They define this organizational component as the knowledge used by coaches to establish optimal training and competition conditions by structuring and coordinating various coaching tasks. The categories included in organization were: planning training, working with assistants, working with parents, helping gymnasts with personal concerns, monitoring weight and esthetics. The most pervasive category within the organizational component was "planning training." A study by Santos, Mesquita, Graca and Rosado (2010) is consistent with these findings and shows that coaches' perceptions of important knowledge areas included planning (yearly and consecutive years), practice and competition orientation, personal and coaching education/competencies. The coaches in this study indicated that broadly speaking, more professional training is necessary and this profession development should be emphasized for factors that affect training components (Santos, Mesquita, Graca, Rosado, 2010).

Again, it is interesting to note that "planning training" is such an important part of coaching, and yet, most expert gymnastic coaches do not have a ready made plan with generic knowledge that can supplement their coaching. This lack is especially

problematic since working with assistants and delegating coaching responsibilities is an integral part of coaching; any supporting sport generic knowledge could help when doing assessments of individual gymnasts. One should note that while these studies by Cote & Samela are seminal, their limitation is their relative currency. That is, with regards to the knowledge of high performance gymnastic coaches, their studies were published in 1995/1996 and there has been plenty of time for these results to change.

CATEGORIES OF KNOWLEDGE

In their study, Cote, Samela & Russell (1995) list important concepts and strategies used by high performance gymnastic coaches and divides them into six different components: competition, training, organization, coaches' personal characteristics, athlete's personal characteristics and level of development, and contextual factors. They further determine that the coach's knowledge that has the most direct impact on an athlete's development is implemented within organizational, competition, and training settings (Cote, Samela & Russell, 1995). Again, here the importance of organization is highlighted as one of the most significant aspects of athlete development and thus athletic performance. Since planning training being a component of organization further suggesting that a generic plan would be beneficial for coaching gymnastics.

Cote, Samela & Russel (1995) mention that knowledge within and about competition and training settings also has a great influence on athlete performance. Many of the properties of the categories "training" and "competition" could further be divided into smaller categories. Competition components are categorized as "competition site," "competition floor," and "trial competitions," while the components of training are

categorized as “coach involvement in training,” “intervention style,” “technical skills,” “mental skills and simulation” (Cote, Samela & Russel, 1995). Cote, Samela and Russel (1995) indicate that coaches are minimally involved with the gymnasts in competition. This minimal interaction could be important to consider when evaluating what knowledge areas require more emphasis and how to further create a generic plan for gymnastic coaches. Hence, the areas in which coaches will be more involved or need a greater knowledge-base are located within training settings and thus it would beneficial to focus resources in this area.

The two training subcategories, “technical training” and “mental skills,” highlight important knowledge categories needed by gymnastic coaches in that they reveal the interdisciplinary aspect of sport performance and suggest that mind-body connections are important for sport excellence (Aoyagi, Portenga, Poczwardowski, Cohne, Statler, 2011). Thus, when considering strategies of sport performance improvement, not only the physical components should be considered but the psychological factors as well (Baker & Horton, 2004). The technical skills referred to by Cote, Samela & Russel (1995) are a key knowledge component of expert coaches since without proper technique it is hard to progress to a more difficult level. Harder skills increase the stress on the athlete’s body and coaches need to be able to match the physical demands of a gymnastic skill to an athlete’s physical abilities. A gymnast’s progress is measured by consistency in training and the monitoring and evaluation of certain skills or movements that the particular “physical factor” was aimed to help. The subcategory “mental skills” refers to the psychological aspects of the sport and exists in relation to an athlete’s mental readiness. This category includes the coach’s knowledge about mental skills as well as their

assessment of the athlete's mental readiness; if a gymnast is not mentally ready for a certain skill, this particular skill should not be stressed (Cote, Samela, & Russell, 1995).

FACTORS INFLUENCING PERFORMANCE

In their review of influences on sport expertise, Baker and Horton (2004) discuss primary and secondary influences on the development of elite performance. Primary influences contribute indirectly or directly to performance and are categorized as genetics, training (physical factors such as acquisition of motor skills, visual acuity, and amount of practice) and psychological factors (common mental characteristics: motivational factors, management of anxiety, concentration, risk-taking, competitiveness). Secondary factors that can influence the primary factors are: socio-cultural, instructional resources, familial support, sport maturity, and level of competition. Even if these primary and secondary factors contribute to and influence performance in sport, the effect that they have on the performance lies within their internal relationships to each other. The extent to which each factor influences an athlete's performance varies from person to person, and the equation of environment and genetics is unique to each athlete and therefore limits sport expertise research by this uncertainty (Baker & Horton, 2004).

According to Ericsson & Charness (1994), the most likely factor for expert performance is the engagement in deliberate and sustained practice over numerous years. However, genetics influences the performance as to individual activity level and temperament of the athlete. Their study further indicates that there is only a limited number of ways to create large improvement in performance (Ericsson & Charness,

1994), a notion backed up by Reilly, Morris & Whyte (2009) who go on to caution that every sport-specific event requires its own set and combination of traits and factors. Thus, to enhance performance and to elicit specific and desirable adaptations in a certain area, one should focus on the most necessary and specific factors in relation to that particular sport. One big challenge for coaches is to specify important factors and to allow time and effort into each of these as to optimize performance (Reilly, Morris, & Whyte, 2009).

Since every sport event has specific factors that are important to peak performance, it would make sense to identify these factors that are important to gymnastics as well as to have a ready-made plan or recommendation that would help the coaches in their planning of training and practice, but yet be broad enough to be able to be modified according to each specific situation and athlete. Given the need for such a plan, we must consider what such a document would include. When looking at factors that are important to high performance and to incorporate in training, traditional talent identification should be considered. Traditional talent identification includes tests based on physical, anthropometric, psychological, sociological, coordinative and technical factors. Adequate motor coordination is a building block for development of fundamental movement skills and fundamental movement skills has been viewed as another stepping-stone to the development and learning of specific sport-skills and peak performance (Vandorpe, et al. 2012).

Vandorpe, et al. (2012) shows that the physical performance of a gymnast reflects their current ability rather than their potential to excel later on in their athletic career. Hence the gymnast's current physical abilities and results have little or no correlation

with previous performance. Therefore, a coordination test must be able to distinguish between elite and non-elite gymnasts and are a better predictor of future success than sole test only measuring the athletes' current physical abilities. On an elite level, performance is more attributed to better coordination than physical abilities, compared to on a lower level of competition where lack of coordination can be compensated with an increase in and better physical abilities than the other competitors at the same level. This difference suggests that in lower levels of competitive gymnastics, emphasis should be placed on increasing the gymnast's physical abilities, while in higher levels, coordination is key. Yet this system does not indicate when and which ability should be trained first and in which stage of athletic development. If certain windows of opportunities exists for developing coordination and physical abilities in a young athletes, should these windows dictate what are to be trained and when? Or should the training be decided on the basis of current level of competition that a certain gymnast is at the moment? The answer may be found in existing literature but are not within the scope of articles reviewed in this paper and further research is recommended. Additionally, these results do not include important psychological and environmental factors that can contribute to the development of peak performance. Rather, what can be concluded is that motor coordination is an important indicator for potential talent within homogenous groups of gymnasts with similar anthropometric profiles. No matter what level the athletes competing at, it is important to develop their athletic abilities. McGuigan, Wright, & Fleck (2012) refer to the goal of athletic preparation as to maximize the performance during a competition. According to Dorgo (2009), the purpose of coaching is to improve the physical, mental and emotional, aspects in athletes and to prepare them for competition. From these two statements we

can conclude that a coaching and athletic preparation can be used interchangeable.

Expert coaches have extensive knowledge that is usually accumulated over many years of coaching, knowledge that is sport- and athlete-specific, including different communication strategies (Dorgo, 2009). If physical abilities are what differentiates high-level gymnastics from low level of performance (Vandorpe, et al. 2012) these would be factors worth additional consideration from coaches when planning training sessions. This idea is backed up by Reilly, Morris, & Whyte (2009) who state that identifying physiological factors for performance are crucial when analyzing athletes and to optimize training.

Strength training and conditioning is an essential part of athletic preparation and necessary to achieve high performance and to avoid injuries (Dorgo, 2009). Strength training has been shown to increase the strength, power, acceleration, vertical jump, and speed of athletes as well as increasing muscle mass and decrease the risk of injury. The physical abilities that can be trained through strength training separate athletes and their performance from each other, even though there is limited research on transfer of strength to motor performance. The transfer of physical abilities are very sport-specific insofar as how much they will enhance the performance of the individual event and importance depends on the activity performed (McGuigan, Wright, & Fleck, 2012).

A strength and conditioning coach's practical knowledge can be dived into two separate categories: foundational knowledge and applied knowledge. Foundational knowledge of strength and conditioning includes broad and diverse parts that can be divided into subcategories: strength and conditioning, facility and equipment, exercises

and techniques, injuries, athletes that they are currently coaching, and planning. The applied knowledge categories usually emerge form everyday coaching actions and include: plan modification, supervision, coaching pedagogical strategies, and professional development. The most prevailing knowledge category within the "applied knowledge" was the "plan modification" that refers to by the ability of the coach to frequently adjust and revise planned programs due to changing conditions (Dorgo, 2009).

According to Jones, Neuman, Altmann, & Dreschler (2001), athletes' mental attitude can affect their performance. This is supported by Harmison (2006) who claims that certain psychological profiles are connected with athletic excellence and that it has been attempt to identify psychological skills that are related to peak performance.

The athlete's mental attitude that indicates and/or affects athletic performance can be divided into six areas: competitiveness, emotional control, mental toughness, positive attitude, safety consciousness, and team orientation. The highest correlations with performance are competitiveness, positive attitude, and team orientation (Jones, Neuman, Altmann, & Dreschler, 2001). A gymnastics psychological profile that is connected to peak performance often contains aspects of high self-confidence, high-energy, but the capacity for relaxation, control over feelings, the ability to concentrate and focus on task, a positive attitude, and motivation towards the task (Harmison, 2006). The psychological skills that are related to peak performance include goal-setting, imagery, competition and refocusing plans, coping skills, thought control strategies, strategies to manage emotions and attention control. Practicing these skills increases the possibility of a higher personal peak performance (Harmison, 2006).

There has been very limited experimentation in applied sport psychology and there are limited supporting research, but reviews show that cognitive-behavioral interventions can effectively regulate mental and emotional states of the athlete and thus improve performance (Harmison, 2006).

CONCLUSION

What is widely understood is that physical as well as psychological abilities can affect the outcome in sport and be related to peak performance and excellence. The wealth of research also highlights important factors and questions in relation to physical abilities and motor coordination. While it is widely accepted among coaching scholars that planning and organization of training is one of the key elements of effective coaching and athletic development, expert gymnastic coaches do not usually have a ready-made plan that they follow. Almost as important as the lack of a culture of planning in gymnastic circles is a lack of agreement on the standards for effective coaching and how coaches integrate learning and practices from theoretical sources into applied knowledge. Planning and organization of training is an important factor for high performance in gymnastics, but if the coaches do not have the appropriate knowledge for optimal training it can be hard to organize in a yearly plan since there is no "expert knowledge" to use. While formal training is always valuable (though not necessarily correlated to overall coaching-effectiveness), an important factor for competent coaching is experiential knowledge gained thru years of practice. Likewise important for effective coaching is informal, mentoring.

The next phase of this study of gymnastics coaching would be to test the efficacy of a widespread mentoring program and network in combination with a generic plan for

gymnastics coaches. This generic plan should be broad enough to satisfy the need for rapid modifications in situations that emerges as well as satisfy the need of flexibility when coaching different athletes at different levels of development. Further, this plan would also provide a more in-depth exploration and specification of components important to peak performance in gymnastics and how to best create enhancement thereof. This plan could also be an information resource and compliment to coaches that are not directly working under a mentor in their day-to-day coaching.

REFERENCES

Aoyagi, Portenga, Poczwardowski, Cohne & Statler (2011). Reflections and directions: The profession of sport psychology past, present, and future. *Professional Psychology: Research and Practice, 1-7.* DOI: 10.1037/a0025676

Baker, J., & Horton, S. (2004). A review of primary and secondary influences on sport expertise. *High Ability Studies*, *(15)2*, 211-228.

Cote, J., Samela, J., & Russell, S. (1995). The knowledge of high-performance gymnastic coaches: Methodological framework. *The Sport Psychologist, (9)1*, 65-75.

Cote, J., Samela, J., & Russell, S. (1995). The knowledge of high-performance gymnastic coaches: Competition and training considerations. *The Sport Psychologist, (9)1,* 76-95.

Cote, J., & Samela, J. (1996). The organizational tasks of high-performance gymnastic coaches. *Sport Psychologist*, *(10)3*, 247-260.

Dorgo, S. (2009) Unfolding the practical knowledge of an expert strength and conditioning coach. *International Journal of Sport Science & Coaching*, (4)1, 17-30.

Dowdell, T. (2010). Characteristics of effective gymnastic coaching. *Science of Gymnastics Journal*, *(2)1*, 15-24.

Ericsson, A., & Charness, N. (1994). Expert performance. Its structure and acquisition. *American Psychologist*, *(49)8*, 725-747.

Greenwood, D., Davids, K., & Renshaw, I. (2012). How elite coaches' experiential knowledge might enhance empirical research on sport performance. *International Journal of Sports Science & Coaching, (7)2*, 411-422.

Harmison, R. (2006). Peak performance in sport: Identifying ideal performance states and developing athletes' psychological skills. *Professional Psychology: Research and Practice, (37)3*, 233–243.

Jones, J., Neuman, G., Altmann, R., & Dreschler, B. (2001). Development of the sports performance inventory: A psychological measure of athletic potential. *Journal of Business and Psychology, (15)3*, 491-503.

MacDonald, D., Cote, J., & Deakin, J. (2010). The impact of informal coach training on the personal development of youth sport athletes. *International Journal of Sports Science & Coaching, (5)3*, 363-372.

McGuigan, M., Wright, G., & Fleck, S. (2012). Strength training for athletes: Does it really help sport performance? *International Journal of Sport Physiology and Performance, 7,* 2-5.

Nash, C., & Sproule, J. (2011). Insights into experiences: Reflections of an expert and novice coach. *International Journal of Sports Science & Coaching*, *(6)1*, 149-161.

Reilly, T., Morris, T., & Whyte, G. (2009). The specificity of training prescription and physiological assessment: A review. *Journal of Sport Sciences*, *27(6),* 575-589.

Santos, Mesquita, Graca, & Rosado (2010). Coaches' perceptions of competence and acknowledgement of training needs related to professional competences. *Journal of Sports Science and Medicine, 9,* 62-70.

Vandorpe, B., Vandendriessche, J., Vaeyens, R., Pion, J., Lefevre, J., Philippaerts, R., & Lenoir, M. (2012). The value of a non-sport-specific motor test battery in predicting performance in young female gymnasts. *Journal of Sport Sciences*, *30(5),* 497-505.

Appendix A: Annotated Bibliography

EFFECTIVE COACHING AND FACTORS CONTRIBUTING TO HIGH PERFORMANCE IN GYMNASTIC

Aoyagi, Portenga, Poczwardowski, Cohne & Statler (2011). Reflections and directions: The profession of sport psychology past, present, and future. ***Professional Psychology: Research and Practice, 1-7*****. DOI: 10.1037/a0025676**

This article is a review of the history of sport psychology and its interdisciplinary background as well as an examination of its present state while making suggestions for the future. Aoyagi et al. focus on the development of sport psychology as an applied profession. Coleman Griffith can be said to be the father of sport psychology in North America and due to him the goal of sport psychology is performance. On the other hand, Bruce Ogilvie can be viewed as the father of applied sport psychology in North America. Both Griffith and Ogilvie developed two different models but yet both referred to their work as sport psychology. Today, there are two major issues that limit the profession: certifications and title usage. This maybe because of the interdisciplinary background of the field and the lack of appropriate training and degrees offered. Future training in sport psychology should address performance excellence, mental health counseling, consulting psychology and different

performance specialty domains.

Baker, J., & Horton, S. (2004). A review of primary and secondary influences on sport expertise. ***High Ability Studies, (15)2*****, 211-228.**

In their article, Baker and Horton (2004) review factors that can affect sport performance. They refer to primary and secondary influences on the development of elite performance. Primary influences contributes indirect or direct to performance and is categorized in genetic, training (acquisition of motor skills, visual acuity, amount of practice) and psychology factors (common mental characteristics, motivational factors, focus, manage anxiety, concentration, risk-taking, competitiveness). Secondary factors can influence the primary factors and are: socio-cultural, cultural importance, instructional resources, familial support, contextual factors, sport maturity, and depth of competition. Even if these factors contribute to performance in sport, the effect lies within the relationship between these variables and it is thereby limited by uncertainty.

Cote, J., Samela, J., & Russell, S. (1995). The knowledge of high-performance gymnastic coaches: Methodological framework. ***The Sport Psychologist, (9)1*****, 65-75.**

This study focused on coaches. The present study intention was to directly ask high-performance expert gymnastic coaches about the important concepts and strategies that they use in coaching. The authors interviewed 17 expert, high-performance Canadian gymnastic coaches with the objective of building an organizing system of categories that emerged

from the unstructured data and that represented the organization and utilization of expert high-performance gymnastic coaches' knowledge. The result of the study, regardless of if the coaches or athletes were female or male, consisted of six components: 1. competition, 2. training, 3. organizing, 4. coaches' personal characteristics, 5. athlete's personal characteristics and level of development, 6. contextual factors. The study showed that it was far less likely that gymnastic coaches have a ready-made schema that contains the generic knowledge necessary to develop elite gymnasts. Rather, the perception of a particular athlete or any challenging situation generates knowledge from different components that, when combined, provides a new and unique estimation for each gymnast. The most important knowledge sources that helped the coaches to develop their coaching style were their own experience and other successful coaches.

Cote, J., Samela, J., & Russell, S. (1995). The knowledge of high-performance gymnastic coaches: Competition and training considerations. ***The Sport Psychologist*****,** ***(9)1*****, 76-95.**

The purpose of this study was to report the knowledge used in training and competition by 17 expert high-performance gymnastic coaches. The study divided the activity of coaching into to two categories: competition and training. These categories were further divided into sub categories: the competition component is defined as the knowledge used by coaches to help gymnasts perform according to their potential in competitions and is

further divided into three sub-categories: competition floor**,** competition site and trial competitions. The study indicated that coaches are minimally involved with the gymnasts in competition. The training component is defined as a coach's knowledge used to help gymnasts acquire and perform different skills in training and was divided into five subcategories: coach's involvement in training, intervention style, technical skills, mental skills and simulation.

Cote, J., & Samela, J. (1996). The organizational tasks of high-performance gymnastic coaches. *Sport Psychologist*, *(10)3*, 247-260.

This article focuses on the organizational tasks of expert, high-performance gymnastic coaches and the aim of the study was to identify and categorize the organizational tasks of expert gymnastic coaches through qualitative research. In-depth interviews were conducted with 17 expert, high-performance, Canadian gymnastic coaches, each with a minimum of 10 years of coaching experience and who each had developed at least one international-level gymnast and two national-level gymnasts. Nine of the coaches worked with male athletes and eight worked with female athletes. The study revealed that nearly 24% of coaching is represented by an organization component. This component was defined as the knowledge used by coaches to establish optimal training and competition conditions by structuring and coordinating various coaching tasks. The categories included in organization were: planning training,

working with assistants, working with parents, helping gymnasts with personal concerns, monitoring weight and esthetics.

Dorgo, S. (2009). Unfolding the practical knowledge of an expert strength and conditioning coach. ***International Journal of Sport Science & Coaching*****,** ***(4)1*****, 17-30.**

The purpose of this study was to show the practical knowledge of an expert strength and conditioning coach through a case study. Strength training and conditioning is an essential part of athletic preparation and necessary to achieve high performance and to avoid injuries. The practical knowledge of a strength and conditioning coach can be dived into two separate categories: foundational knowledge and applied knowledge. Foundational, practical knowledge included broad and diverse parts of strength and conditioning coaching and included subcategories such as knowledge of strength and conditioning, facility and equipment, exercises and techniques, injuries, athletes and planning. The applied practical knowledge categories usually emerge form everyday coaching actions: plan modification, supervision, coaching pedagogical strategies, and professional development. The most prominent knowledge categories of these four was the plan modification by the ability to frequently adjust and revise planned programs due to changing conditions.

Dowdell, T. (2010). Characteristics of effective gymnastic coaching. ***Science of Gymnastics Journal, (2)1*****, 15-24.**

This study surveyed 120 gymnastic coaches from five top gymnastic clubs

in Australia, investigating the characteristics of effective gymnastics coaching. The result shows a list of key attributions of gymnastic coaching: effective teaching, sport specific knowledge, goal setting, and envisioned excellence in an integrated practice. Factors that were learned by the coaches during coaching with specific athletes were inter-personal communication, leadership, "spotting", visually analyze skill practice, predict desired outcomes and monitoring students.

Ericsson, A., & Chamess, N. (1994). Expert performance. Its structure and acquisition. ***American Psychologist, (49)8*****, 725-747.**

Ericsson and Chamess review and reexamine the existing literature on expert performance and propose different ways to study performance and achievement. They show how to identify and capture performance in a laboratory setting and what how it changes both cognitive and physiological processes in the athlete. Their findings show that the most likely factors for expert performance are the environment, the engagement in deliberate and sustained practice over numerous years, genetics, and individual temperament.

Greenwood, D., Davids, K., & Renshaw, I. (2012). How elite coaches' experiential knowledge might enhance empirical research on sport performance. ***International Journal of Sports Science & Coaching, (7)2*****, 411-422.**

Greenwood, Davids and Renshaw (2012) seek to explain athlete performance through the experiential knowledge of elite coaches and

athletes. Even if sport scientists and elite coaches have similar perceptions of the importance of performance research, there have been few studies which have utilized the knowledge of elite coaches to enhance the theoretical understanding of athletic performance and training. The authors of this article analyzed coaches' experiential knowledge of the run-up task in three different sports where a run-up is included in the particular activity, as for example a run-up to the plan in long jump or run-up to the vault in gymnastic. The study was based on a four-section interview of 15 elite coaches in three different sports: track and field, gymnastics, and cricket (fast bowling). Their conclusion is that the experiential knowledge of elite coaches may be valuable in development of sport performance. Coaches often found that their experiential knowledge often supplemented the existing scientific knowledge.

Harmison, R. (2006). Peak performance in sport: Identifying ideal performance states and developing athletes' psychological skills. ***Professional Psychology: Research and Practice, (37)3,*** **233–243.**

This article describes the field of sport performance in relation to psychological factors. The author describes two models for application in sport performance as well as highlighting the role of athlete awareness and the importance of following a developmental approach to sport performance. The article indicates that a certain psychological profile is

connected with athletic peak performance. It also identifies psychological skills that are related to peak performance including goal setting, imagery, competition and refocusing plans, coping skills, thought control strategies, strategies to manage emotions, and attention control.

Jones, J., Neuman, G., Altmann, R., & Dreschler, B. (2001). Development of the sports performance inventory: A psychological measure of athletic potential. ***Journal of Business and Psychology*****,** ***(15)3*****, 491-503.**

This study looked at the relationship between an athlete's attitude and their performance. A Sport Performance Inventory was conducted and surveyed 274 students in a mid-divisional university. They discovered six areas that can affect athletic performance they are competitiveness, emotional control, mental toughness, positive attitude, safety conscious and team orientation. With the highest correlation with high performance being within, competitiveness, positive attitude and team orientation

MacDonald, D., Cote, J., & Deakin, J. (2010). The impact of informal coach training on the personal development of youth sport athletes. ***International Journal of Sports Science & Coaching, (5)3*****, 363-372.**

Because coaches interact with athletes, they, by definition, have an impact on the development of youth. Athletes participating in a sport under a trained coach have higher self-esteem by the end of the season compared to if lead by an untrained coach. This shows that coaches can have a positive or negative affect on athletes' sport experience. The purpose of this study was to establish if coach training with emphasis on positive

youth development would increase the personal development of athletes. The study entailed a survey of two different test groups. One group consisted of program administrators from ten different community sport programs. The second group was 109 athletes from the same sport programs. Results show that informal coach training is connected to increased personal and social skills and that coaches can positively impact youth's development, even without formal training. However, the study did not establish wether informal or formal coaching training is to be preferred.

McGuigan, M., Wright, G., & Fleck, S. (2012). Strength training for athletes: Does it really help sport performance? ***International Journal of Sport Physiology and Performance, 7*****, 2-5.**

This article reviews the field of strength training and tries to determine if strength training actually improves athletic performance. Strength training has been shown to increase strength, power, acceleration, vertical jump, and speed as well as increasing muscle mass and decreasing the risk of injury. The physical abilities that can be trained through strength training is what separates different athletes performance levels, however, as to what extent the degree of strength improvement will result in enhanced performance is very sport-specific. The importance of strength and power to sport specific performance tend to depend on the nature of the sport activity performed. However, strength training can be the discriminating factor that differentiates between different performance levels.

Nash, C., & Sproule, J. (2011). Insights into experiences: Reflections of an expert and novice coach. ***International Journal of Sports Science & Coaching*****, *(6)1*, 149-161.**

The purpose of this study was to assess how coaches create their knowledge and to provide and understanding into the practical application of their experience in learning. Much current research focuses on expert coaches but not as much has focused on how these expert coaches become "expert". The results of the study are based on interviews with two female swimming coaches: one expert coach and one novice. The findings support the idea that in many different occasions, coaches have a hard time applying knowledge that they have gained from a coaching course. Thus, there is a need for a well-developed knowledge-base and a further understanding in how to put the theory into practice.

Reilly, T., Morris, T., & Whyte, G. (2009). The specificity of training prescription and physiological assessment: A review. ***Journal of Sport Sciences*****, *(27)6,* 575-589.**

This review tries to identify physiological factors affecting performance by considering training specificity of aerobic, strength and power as well as cross-training methods. Identifying physiological factors for performance are crucial when analyzing athletes and as to optimize training. Optimal performance is dependent on many factors, including

genetics and the environment. Every sport-specific event requires its own set and combination of traits and factors. To enhance performance and to elicit specific and desirable adaptations one has to focus on the most necessary and specific factors of peak performance in the sport.

Santos, Mesquita, Graca, & Rosado (2010). Coaches' perceptions of competence and acknowledgement of training needs related to professional competences. ***Journal of Sports Science and Medicine, 9,*** **62-70.**

This study is based on a questionnaire completed by 343 coaches from different sports and examines the coaches' perception of areas of competency that needs to be emphasized in coaching education. Several factor were perceived to need more emphasis: planning (yearly and consecutive years), practice and competition orientation, personal and coaching education/competencies, with a slight emphasis on the training factor.

Vandorpe, Vandendriessche, Vaeyens, Pion, Lefevre, Philippaerts, & Lenoir (2012). The value of a non-sport-specific motor test battery in predicting performance in young female gymnasts. ***Journal of Sport Sciences*****,** ***(30)5,*** **497-505.**

This study attempts to identify performance characteristics that can used to predict performance in competition two years in advanced. This study used a multidimensional test battery measuring 23 female gymnasts as well as an evaluation by expert coaches. The findings show that measures of physical performance reflect the current ability of a gymnast rather than

the potential to excel and have little or no correlation with current results and previous performance. Coordination tests have been able to distinguish between elite and non-elite gymnasts and are a better predictor of future success than what test of physical abilities are. This means that on an elite level, performance is more determined by better coordination than physical abilities, whereas on a lower level of competition, lack of coordination can be balanced out with an increase in and better physical abilities. This study did not include important psychological and environmental factors that can contribute to development of peak performance.