Original Article

Learning styles of elite and sub-elite athletes

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ABSTRACT

Braakhuis, A.J. (2015). Learning styles of elite and sub-elite athletes. *J. Hum. Sport Exerc., 10*(4), pp.927-935. Athletes have preferences for the way in which they internalise and process information. Athlete educators, such as coaches and sports medical staff, rarely consider the learning style of an prior to education. This study aims to characterise a range of athletes with regards to their learning style, to increase awareness and conversation about athletes as learners. Athletes (*n*=93; 44 males, 49 females), age 24 ±8 yrs, completed the VARK (Visual, Aural, Read/write and Kinesthetic) questionnaire and outcomes were analyzed by Chi-Square analysis. Athletes were predominantly K (38%) and MM (33%) in their learning preferences. There was a significant relationship between gender and VARK preference (X2= 15.1, $p<0.05$), between athletic status and VARK preference (X2=20.4, $p<0.05$), but little relationship between individual or team sport athlete and VARK preference (X2= 5.3, $p=0.16$). Very few athletes had a visual learning-style preference (*n*=1). Those working with athletes should be aware of the preference for MM and K learning-styles and the inadequacy of presenting information visually. **Key words**: SPORTS, ATHLETIC PERFORMANCE, COUNSELLING, EDUCATION.

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INTRODUCTION

In today's sport-obsessed society, the modern day athlete is reliant on the advice and support of an education and professional team; from coaches, doctors, dietitians, strength and condition staff and physiotherapists, to name a few. Professionals typically play a role in supporting athletes by providing advice on injury prevention, training and recovery strategies, rehabilitation, mental skills and nutrition, while coaches manage the training and competition aspects of the athlete. As such, both coaches and professionals are educators of athletes. The ability to provide effective support and instructional advice is crucial to any successful individual or team sport athlete (Orchard, Fricker, Brukner, 1995).

There is a strong intuitive appeal in the idea that athlete educators, should pay closer attention to athletes' learning styles, by diagnosing them and by designing teaching and learning interventions around them. Further evidence for the notion that athletes have individual learning styles appears when athlete educators notice that athletes vary in the speed and manner with which they pick up new information and ideas. The modern-day athlete educator aims to empower the athlete to self-manage their athletic program, and becomes a facilitator to the athlete. Understanding the range and scope of learning styles of athletes may encourage an athlete educator to think broadly about athlete instruction.

There are various learning style inventories, each with its advantages and flaws. Of all those in existence, only one has been designed and tested with an athletic population in mind. The VARK learning style inventory is a popular assessment of an individual's learning style as it is a valid, simple, easy-to-use and has a wealth of supporting material (Leite, Svinicki, Shi, 2009). The VARK inventory is designed to measure four different perceptual preferences thought important to athletes, which are visual (V), aural (A), read/write (R) and kinesthetic (K). V-individuals prefer to learn information presented in charts and graphs, A-individuals prefer spoken lessons and talking, R-individuals prefer to learn from printed material and K-individuals prefer to learn through practice. An additional category is a mixture of learning styles, called multi-modal (MM), a mixture of 2 or more preferences. The VARK preferences are independent of personality characteristics, information processing and social strategies (Leite, Svinicki, Shi, 2009). Previous research has shown the VARK inventory to be reliable (Leite, Svinicki, Shi, 2009).

At present the VARK questionnaire for athletes has been used by coaches to tailor instruction by matching the perceptual preference of athletes with instructional method 3. The non-athlete version has also been heavily utilized in the teaching environment, where particular learning styles relate to better outcomes outside the classroom (Leite, Svinicki, Shi, 2009). Athletes interacting with the educators are constantly taking in and applying new information; it is therefore, vital the educators adopt learning-style based instruction to maximize the efficiency of their care. To date, the characterisation of learning styles of athletes has not been researched. Previous research suggests that students whose learning styles were being accommodated could be expected to learn 75% of a standard deviation higher than students who had not had their learning styles accommodated (Dunn, Griggs, Olson, Beasley, Gorman, 1995). Firstly, an appreciation of the range and depth of learning styles of athletes needs to be considered (Fuelscher, Ball, MacMahon, 2012).

The aim of this study is to examine the relationship between assessed sensory modality preferences and athlete status, gender, and sport, using the VARK athlete questionnaire. The outcomes of the research will increase awareness and conversation about athletes as learners, as a precursor for athlete educators to use appropriate instructional methods for their athlete audience.

MATERIALS AND METHODS

Athletes (*n*=93) from a variety of sports and sport achievement level completed a questionnaire, including the VARK inventory previously validated for use with athletes (Boyde, Tuckett, Peters, Thompson, Turner, Stewart, 2009). Athletes were from New Zealand and the United States. Athletes were first asked if they wished to participate in the study and were provided participant information sheet detailing the purposes and aims of the study. Athletes were then provided a consent form and the VARK questionnaire. For athletes within an elite team, approval from the National Sporting Body was obtained. Athletes that agreed to take part were given a consent form and participant information sheet, upon signing the consent form, questionnaires were then distributed. Questionnaires were completed in pen and handed back to one of the researchers. Athletes excluded personal details from the questionnaire, unless individual feedback was requested.

All experimental procedures were approved by the University of Auckland Human Participants Ethics Committee, reference number 9399. Experimental procedures performed in the United States of America were approved by San Diego State University Division of Research Affairs – Human Research Protection Program. Protocol number 1212087.

Questionnaire

The Questionnaire was composed of two sections. The first section asked athletes to identify their name (for the purpose of providing learning style feedback), gender, highest level of sport competition in the last 2 years (international, national, regional, recreational), sport and age, as well as whether they play an individual or team sport. Athletes that had competed at a international or national level were classes as elite, those that competed regionally or recreationally were considered sub-elite for the purposes of analysis. The second component of the questionnaire was composed of the 13 questions from Fleming's VARK inventory for athletes which were used to determine each athlete's assessed sensory modality preference (Fleming, 2014). The Copyright permission for the use of the VARK inventory was send via email (June, 2013) and approval granted for the paper version only. Copyright of the athlete VARK questionnaire is held by Julia Dunn (Whitman College, Walla Walla, Washington, USA) and Neil Fleming, (Christchurch, New Zealand). Athletes with fewer than 10 responses in the VARK questionnaire were not included in the analysis in accordance with Flemings (2001) scoring system for the VARK questionnaire. The sensory modality preference was assessed using the "stepping stone" scoring criteria outlined by Fleming (2001) to determine whether the athlete is unimodal (V, A, R, K) or multi-modal (MM). A multimodal preference occurs when a person has a strong preference for 2 or more of the VARK modes (Fleming, 2001).

ANALYSIS

For the completed questionnaires, the athletes' names were replaced with a numeric code, analysis was preferred using SPSS (Version 20, IBM Corporation, Armonk NY, USA). Statistical associations among athlete status, gender, and age were made with assessed sensory modality preference, respectively, using Pearson Chi-Square analyses (X2). Where cell counts were below five the Fisher's exact test (X2) was used to assess statistical associations. Statistical significance was set at $P < 0.05$. All tests were 2-tailed. For this investigation athletes were grouped into Elite (International & National athletes) and Recreational (Regional & Recreational athletes) in order to assess any association between athlete status and assessed VARK preference. Furthermore, we chose to omit the one participant with a V preference in our analysis as the cell counts for a V preference were too low to conduct an accurate statistical significance test. This is

justified as the V modality occurs in less than 1% of athletes (Dunn, 2009), and is therefore unlikely to be relevant to this investigation. Data are expressed as either means ± SD, percentages or whole counts.

RESULTS

A total of 93 athletes completed the questionnaire; ranging in ages from 16 to 53 years old (see Table 1). Participating athletes were recruited in both New Zealand and the United States of America. In total 106 athletes were approached with 18 athletes choosing not to participate in the study, or failing to return a completed questionnaire or consent form. The response rate was 88%. Twenty-four sports were represented in the study cohort (see Table 2). For inclusion, the "athlete" participant was expected to have competed at least once in an organized competition in the year prior. The highest level with which the competition was held determined the athlete status (recreational, regional, national or international).

Table 1. Characteristics of the Athlete Respondents (*n*=93).

Variable	Mean (SD)
Age (yrs)	24 (8)
Gender	
Male	44
Female	49
Athlete Status	
Elite	57
Sub-elite	36
Individual vs. Team Sport	
Individual	47
Team	46
VARK Preference	
V	1
A	16
R	10
K	35
MM	31

Table 2. Sports Represented in the Athlete Respondents.

Sport	No. of Athletes
Football	6
Rugby Union	3
Netball	8
Surfing	1
Hockey	14
Tennis	1
Triathlon	3
Lacrosse	1
Mountain Biking	3
Skiing	1
Rowing	1
Swimming	8

Cycling	1
Water polo	1
Squash	2
Running	1
Kayak	6
Archery	1
BMX Cycling	9
Track & Field	8
Rugby Sevens	11
Gymnastics	2
Touch Rugby	1
Tag Football	1

Assessed Sensory Modality Preferences

Using the VARK questionnaire for Athletes, the majority of athletes had a Kinesthetic learning style, followed by Multimodal, Aural, Read-write and then Visual (see Figure 1). These results indicate a strong preference for Kinesthetic and Multimodal learning amongst the athlete cohort. Overall, 62% of the study participants were unimodal learners, with the remaining 38% being multimodal learners.

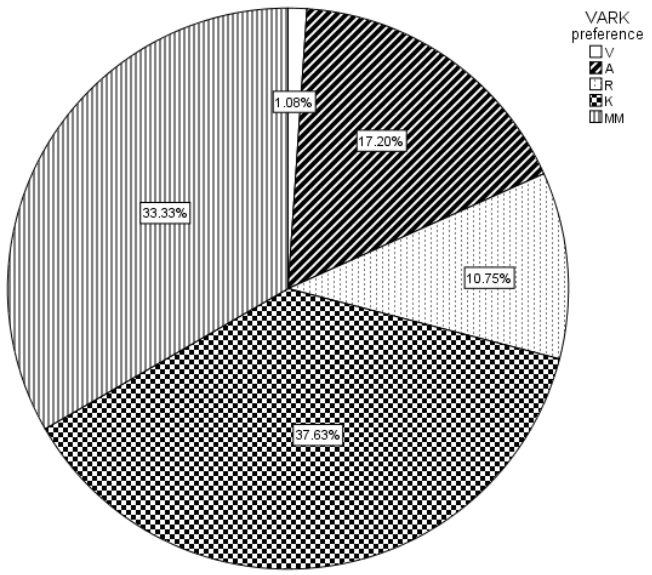

Figure 1. Athlete learning style preference by percent. Data presented as 5-part model. MM=Multimodal; V=Visual; A=Aural; R=Read/Write; K=Kinesthetic.

The X2 analysis between gender and assessed sensory modality preference indicated a difference in learning style between men and women. Male athletes were found to prefer K learning (39%) followed by A (32%), MM (21%), R (8%). On the other hand, 46% of female athletes showed a preference for MM learning followed by K (37%), R (13%), A (4%). The association between gender and assessed sensory modality preference reached statistical significance with a Fisher's exact test (Table 3).

Table 3. VARK Learning Preference Versus Gender, Individual/ Team Sport and Athletic Status (*n*=92).

Variable	VARK Preference [a]				Total	X^{2} [b]	p-value
	A	R	K	MM			
Gender						15.1	0.001
Male	14	4	17	9	44		
Female	2	6	18	22	48		
Athletic Status						20.4	0.006
International	6	8	13	21	48		
National	2	2	3	1	8		
Regional	3	0	11	1	15		
Recreational	5	0	8	8	21		
Athletic status (combined)						13.3	0.003
Elite	8	10	16	22	56		
Amateur	8	0	19	9	36		
Individual/ team sport						5.3	0.16
Individual	9	8	14	15	46		
Team	7	2	21	16	46		

[a] Values are whole counts. [b] Where cell counts were below 5 the Fisher's exact test was used

We also examined the relationship between assessed sensory modality and athlete status. Amongst international athletes 44% were MM learners followed by K (27%), R (17%) and A (12%). National athletes showed a strong preference for K (37%) and A (25%) followed by R (25%) and MM (13%). Regional athletes were mostly K (73%) followed by A (20%) and MM (7%). MM (36%) and K (36%) learning styles were the most prevalent amongst recreational athletes with 23% having an A preference and the final 5% having an R modality preference. The association between athletic status and VARK preference reached statistical significance with a Fisher's exact test. This result may have been influenced by the relatively low count of national athletes (see Table 3).

Differences between athletic status and VARK preference were also present when international and national athletes were combined to make the "elite" group and regional and recreational combined to make the "amateur" group. Elite athletes were shown to have a strong preference for MM (39%) learning followed by *K* (27%), *R* (18%) and *A* (16%). In contrast, over half (56%) of the amateur athletes had a K preference with 25% having a MM preference, followed by *A* (19%) and *R* (0%). The association between elite and amateur athletes and their perceived learning style also reached statistical significance (see Table 3).

Finally we assessed if there was a possible association between individual and team sport athletes and VARK preference. Team sport athletes were 46% K learners followed by MM (35%), A (15%) and R (4%). In comparison, MM (33%) was the most popular preference amongst individual sport athletes followed by K (30%), A (20%) and R (17%). This association fell short of statistical significance with a Pearson Chi-Square (See Table 3).

DISCUSSION

The main findings reveal athletes were predominantly K and MM in their learning preferences. There was a significant relationship between gender and VARK preference between athletic status and VARK

preference, but little relationship between individual/ team sport athletes and assessed VARK preference. Very few athletes had a visual learning-style preference (*n*=1).

In order to appreciate how the learning preferences of an athletic population might differ from a non-athletic population, we compared results to those previously reported by Fleming9. The respondents in our study showed a preference for MM (33%) versus the non-athletic population (65%) 9. Athletes have a much higher K preference (38%) versus non-athletes8 (12%); athletes also indicated a higher A preference (17% in our investigation versus 7% in non-athletes). There was a smaller difference between R preference (11% athletes versus 14% in non-athletes) and V preference (1% athletes versus 3% in non-athletes) (Fleming, 2014). The VARK preferences from the non-athletic population were predominantly from education or academia, which is likely to be reflected in the preferred learning style.

The overall VARK preferences of the athletes in our study differ slightly to those previously reported. Of the athletes completing the VARK questionnaire on-line between the dates of August-September 2003 (*n*=169), using the same 5-part model as our study, 55% were MM (versus our 33%), 35% K (versus our 38%), 5% A (versus our 17%), 3.5% R (versus our 11%) and 1.5% V (1%) (Fleming, 2003). Differences between studies are probably due to the on-line versus paper administration (on-line may bias the sample towards a more educated group), and the definition of "athlete," (which we defined as competing in the previous year, as opposed to a self-selected category). Regardless of study differences, it is clear that athletes have a preference for K and MM learning at the expense of R and V when compared to a non-athletic population.

MM athletes can respond to learning strategies designed for K individuals, therefore we strongly recommend those wanting to educate athletes should utilize learning strategies designed for those with a K learning preference. Strategies designed to support the education of those with a K learning preference include stories, case studies, demonstrations and using real life examples (Fleming, 2013). By incorporating aspects of kinesthetic teaching, athlete educators will support 71% of learners that are either MM or K preferences.

Our investigation found only one respondent with a unimodal V preference amongst the entire study cohort, our finding is consistent with Dunn (2009), who reports less than 1% of the athlete population is comprised of visual learners. Educators of athletes should consider moving away from visual means of information presentation, such as instructional charts, graphs and symbols, when working with athletes. It is, however, difficult to promote a complete move away from visual methods as many multimodal preferences include the visual aspects.

Another important trend identified in our investigation was the association between elite and sub-elite athletic status and assessed VARK preference. Our study found elite and recreational athletes to be significantly different in VARK preference. Dunn (2009) notes that learning style preferences vary among athletes of different levels of sporting competition which is consistent with our findings. Interestingly, we found elite athletes to report a much broader spectrum of learning styles when compared to those of recreational status. Athlete educators who are multi-modal learners themselves may be at an advantage when working with an elite athlete group; given MM learners are able to navigate the different learning styles with ease. Also, health professionals should attempt to incorporate different styles of educating athletes. For example, if educating on the topic of optimal nutrition, supplying a menu plan to every athlete without regard for learning preference is likely to be an unsuccessful approach to initiate behavior change.

Another important finding from our investigation was the trend between gender and assessed VARK preference in which male and female athletes showed significantly different modality preferences. Males had a much higher preference for A-learning, compared to females, while females were more likely to be MM learners. Our findings contrast from those in the general population where a multimodal modality was the most popular preference for both sexes (Choudhary, Dullo, Tandon, 2011; Slater, Lujan, DiCarlo,2007;Wehrwein, Lujan, DiCarlo, 2007). Our results, however, are similar to those reported by Dunn (2009) in that males had a higher preference for A learning (32.5% vs. 4.3% for females). This significant finding suggests that athlete educators working with males should adopt methods of aural information presentation, such as the facilitation of verbal discussion or recording the consultation so the athlete can listen to the information again in the future; it is fortunate in this case that much of athlete educator – athlete communication is verbally orientated.

The use of the VARK questionnaire for athletes has been questioned as a valid tool to assess motor skills (Fuelscher, Ball, MacMahon, 2012), as many of the questions relate to classroom activities. Therefore the potential use of the questionnaire for coaches who need to educate athletes on motor skill activities is questionable. Fortunately, athlete educators are akin to classroom educators regarding material presented to learners, and for this purpose the questionnaire has been shown to be valid.

CONCLUSION

As far as we are aware, this is the first independent study used to characterise athletes' learning preferences according to age, gender and sporting status. We would recommend those working with all athletes incorporate kinesthetic aspects to education, by using real-life examples, demonstrations, photographs, trial and error and hands-on approaches. We would encourage athlete educators working with the elite to expand their teaching repertoire and include all VARK learning strategies, as athletes who are multi-modal require at least two modes involved in learning before they are satisfied. This study should serve as a platform for further research in this field, such as a simultaneous investigation into the athlete educators' teaching style in order to appreciate how communication between the two parties can be enhanced.

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