Sports **2015**, *3*, 325-334; doi:10.3390/sports3040325

OPEN ACCESS

sports

ISSN 2075-4663

www.mdpi.com/journal/sports

Article

A Comparison between Learning Style Preferences, Gender, Sport and Achievement in Elite Team Sport Athletes

Andrea Braakhuis [1,*], Tea Williams [1], Elizabeth Fusco [2], Shawn Hueglin [2] and Alex Popple [3]

[1] Discipline of Nutrition/Dietetics, Faculty of Medical and Health Sciences, The University of Auckland, Private Bag 92019, Auckland, 1142, New Zealand; E-Mail: twil830@aucklanduni.ac.nz

[2] United States Olympic Committee, 2800 Olympic Parkway, Chula Vista, CA 91915, USA; E-Mails: Liz.fusco.nutr@gmail.com (E.F.); Shawn.Hueglin@usoc.org (S.H.)

[3] High Performance Sport New Zealand, Avantidrome, Hanlin Road, Cambridge 3283, New Zealand; E-Mail: Alex.Popple@hpsnz.org.nz

***** Author to whom correspondence should be addressed; E-Mail: a.braakhuis@auckland.ac.nz; Tel.:+64-9-373-7599 (ext. 86251).

Academic Editor: Eling de Bruin

Received: 14 October 2015 / Accepted: 30 October 2015 / Published: 9 November 2015

Abstract: Athletes have preferences for the way in which they internalize and process information, whether that is visual, aural, by-doing (kinesthetic), reading or a mixture of preferences. Health professionals that interact with athletes rarely consider the individual learning style prior to any communication or education, despite mounting evidence for the benefits of learning-style tailored education. The aim of this study was to characterize athletes with regards to their preferred learning style. Athletes (n = 93) from 24 sports and various sport achievement levels completed a questionnaire, including the visual (V), auditory (A), reading/writing (R), kinesthetic (K)/(VARK) Questionnaire for Athletes. Questionnaire outcomes were analysed by X^2 analysis on SPSS. The main findings were: (1) very few athletes have a visual learning-style preference; (2) there was a significant relationship between gender and VARK preference (X^2 = 13.84, p = 0.003); (3) and between athletic status and VARK preference (X^2 = 9.2, p = 0.025); (4) there was a trivial association between individual/ team sport athletes and assessed VARK preference (X^2 = 3.95, p = 0.265). Our findings show significant variation in learning-style preference between males and females, and those of different athletic status. Health professionals should be aware of the inadequacy of visual information presentation when working with athletes. Furthermore, health

professionals working with elite and female athletes should be comfortable using a mixture of learning styles (multi-modal).

Keywords: sports; athletic performance; counseling; education

1. Introduction

In today's sport obsessed society, the modern day athlete is reliant on the advice and support of a health professional team. Health professionals typically play a role in supporting athletes by providing advice on injury prevention, rehabilitation, mental skills and nutrition education. While the majority of research has focused on building the knowledge base of health professionals working with athletes, very little has been done on how to educate health professionals on how they advise athletes. Research has shown athletes have preferences for the ways in which they receive information [1]. The visual (V), auditory (A), reading/writing (R), kinesthetic (K)/(VARK) questionnaire for athletes identifies their preferred mode(s) of presentation of information this mode governs how athletes interpret, process, and understand information. Learners with a visual preference prefer charts, graphs and flow charts among other forms of visual stimuli that could have otherwise been presented in words. Aural learners take in new information by aural and oral methods (hearing and speaking). People with an aural learning preference like to have new ideas explained to them and to discuss topics with others; they can also take in complex and detailed instructions easily. The read/ write mode of learning involves information displayed as text and written words. People with a strong preference for this style of learning find they prefer to use lists, notes, essays and other forms of text-based stimuli to take on and process new forms of information. Kinesthetic learners prefer using experiences and practices rather than conceptual or abstract learning. This type of learner uses their senses to interact with the world around them and enjoys practical opportunities and hands-on approaches to learning new information [1]. An additional category is a mixture of learning styles, called multi-modal (MM).

Gaining insight into athletes preferred mode(s) can (a) help provide healthcare instruction tailored to athletes individual learning preferences to better understand information and improve self-care [1]; (b) overcome the predisposition for health professionals to treat all athletes in a similar way; and (c) be used as a catalyst to encourage health professionals to move from their preferred mode(s) to others [2].

At present the VARK questionnaire for athletes has been used by coaches to tailor coaching instruction to support understanding by athletes by matching perceptual preference with instructional method [3]. It has also been heavily utilized in the teaching environment, where particular learning styles relate to better outcomes outside the classroom [4]. Athletes interacting with the healthcare system are constantly taking in and applying new information; it is therefore, vital that health care professionals adopt learning-style based instruction to maximize the efficiency of their care. To date, health professionals have not incorporated an assessment of an athlete's learning style into rehabilitation or injury management programmes; doing so would likely result in benefits. Current clinical research indicates that education is a pivotal component in effective multi-disciplinary treatment programmes as it enables patients to better understand their condition and acquire adequate skills to perform self-care [2].

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 serve as a valuable tool to health professionals alike to facilitate effective communication and improve health outcomes for athletes.

2. 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 [4]. Athletes were from New Zealand and the United States. Athletes were first asked if they wished to participate in the study via a health professional or research assistant and were administered with a participant information sheet detailing the purposes and aims of the study. Athletes and health professionals completed consent forms. For athletes within an elite team, approval from the National Sporting Body was obtained.

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

2.1. 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. The second component of the questionnaire was composed of the 13 questions from Fleming's VARK inventory for athletes, which was used to determine each athlete's assessed sensory modality preference [5]. A selected question from Fleming's VARK inventory for athletes, is described as "(1) You are about to give directions to an athlete who is standing with you. The athlete is new to town and needs to get to the athletic complex. The athlete has a bike. I would: (a) draw a map on paper, (b) tell him/her the directions, (c) write down the directions (without a map), (d) bike with them to the complex."

Copyright for the use of the VARK inventory was send via email and approval granted for the use of the paper version only. Copyright of the athlete VARK questionnaire is held by Julia Dunn (Whitman College, Walla Walla, WA, USA) and Neil Fleming (Christchurch, New Zealand). Neil Fleming holds the copyright of the original version of VARK from which the Athlete's version was developed. Athletes with fewer than 10 responses in the VARK questionnaire were not included in the analysis in accordance with Flemings [6] scoring system for the VARK questionnaire. The sensory modality preference will be assessed using the "stepping stone" scoring criteria outlined by Fleming [6] 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 [6].

2.2. Analysis

For the completed questionnaires obtained via the health professional, the athletes' names were replaced with a numeric code, and the results from each questionnaire were manually input into SPSS for analysis.

Statistical associations among athlete status, gender, and age were made with assessed sensory modality preference, respectively, using Pearson Chi-Square analyses (X^2). Where cell counts were below five the Fisher's exact test (X^2) 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 [1], and is therefore unlikely to be relevant to this investigation. Data are expressed as either means ± SD, percentages or whole counts.

3. 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%.

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

Variable	Mean (SD)
Age (years)	24 (8)
Gender	
Male	44
Female	49
Athlete Status	
International	49
National	8
Regional	15
Recreational	21
Individual *vs.* Team Sport	
Individual	47
Team	46
Elite/Amateur Status	
Elite	57
Amateur	36
VARK Preference	
V	1
A	16
R	10
K	35
MM	31

Twenty-four sports were represented in the study cohort (see Table 2).

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.

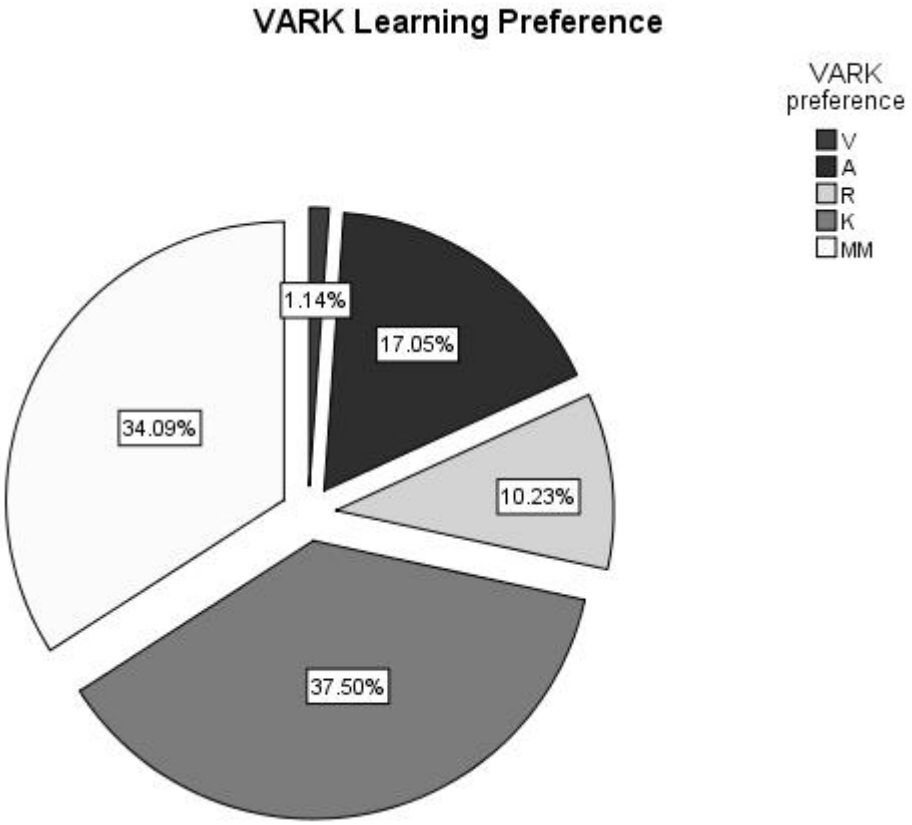

Figure 1. Athlete learning style preference by percent. Data presented as 5-part model. MM = Multimodal; V = Visual; A = Aural; R = Read/Write; K = Kinesthetic.

The X^2 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).

We also examined the relationship between assessed sensory modality and athlete status. Amongst international athletes 46% were MM learners followed by K (27%), R (16%) and A (11%). National athletes showed a strong preference for A (33%) and K (33%) followed by R (17%) and A (17%). 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).

Associations 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).

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

Variable	VARK Preference				Total
	A	R	K	MM	
Gender [a]					
Male	14	4	17	9	44
Female	2	6	18	22	48
Athletic Status [b]					
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) [c]					
Elite	8	10	16	22	56
Amateur	8	0	19	9	36
Individual/team sport [d]					
Individual	9	8	14	15	46
Team	7	2	21	16	46

Notes: Values are whole counts. [a] X^2 = 15.1, p = 0.001; [b] X^2 = 20.4, p = 0.006; [c] X^2 = 13.3, p = 0.003; [d] X^2 = 5.3, p = 0.158; Note: cell counts below 5, were analysed using Fisher's exact test.

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).

4. Discussion

The main conclusions of the study were that (a) there were very few athletes with a visual learning style preference; (b) there was a significant relationship between gender and assessed VARK preference; (c) there was a significant relationship between athletic status and assessed VARK preference; and (d) there was a lack of significance between individual/team sport athletes and assessed VARK preference.

The overall distribution of learning style preferences in this investigation differed significantly from those found by Fleming [7]. The respondents in our study showed a 33% MM preference compared with 65% found by Fleming [7] (n = 145,358). We found a K preference to be much higher in our study (38%) compared to Fleming's [7] (12%); our study also indicated a much higher A preference (17% in our investigation compared with 7%). There was a smaller difference between R preference (11% in our study compared with 14%) and our V preference (1%) was analogous to Fleming's (3%) [7]. The reason for the disparity in preferences between our investigation and Flemings is not clear. Our investigation found only one respondent with a unimodal V preference amongst the entire study cohort, our finding is consistent with Dunn [1] who reports that less than 1% of the athlete population is comprised of visual learners. This result suggests that health professionals working with athletes should move from traditional visual means of information presentation, such as instructional charts and books, when

working with athletes. It is, however, difficult to promote a complete move away from visual methods as many multimodal preferences include the visual mode.

Another important trend identified in our investigation was the association between elite and amateur athletic status and assessed VARK preference. Our study found elite and recreational athletes to be significantly different in VARK preference. Dunn [1] 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. Health professionals 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, distributing nutrition advice and supplying a menu plan to every athlete without regard for learning preference is likely to be an unsuccessful approach to initiate behavior change. Instead, we might suggest a health professional assess an athlete's learning style and tailor instruction likewise, so the R learner receives a meal plan and a K participates in a cooking class, by way of example.

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 multimodal learners. Our findings contrast from those in other studies where a multimodal modality was the most popular preference for both sexes; however, these studies differ from ours in that they used students rather than athletes as well as using the standard VARK questionnaire as opposed to the athlete's version used in our investigation [8–10]. Our results, however, are similar to those reported by Dunn [1] in that males had a higher preference for A learning (32.5% *vs.* 4.3% for females). This significant finding suggests that health professionals working with male athletes should adopt some methods of aural information presentation, such as conducting 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 health professional–athlete communication is verbally orientated.

Limitations

Throughout the process of the investigation, it became evident that many of the athlete participants saw the VARK inventory for athletes to be outdated with respect to current technology. For example, one question asks athletes how they would give directions to another athlete, many of our respondents indicated to us that they would use a smartphone in this situation. However, this was not an option in the questionnaire. The authors would recommend a revised version of the VARK inventory for athletes which acknowledge modern technological advancements. A further limitation of the study is that we chose not to examine the learning styles of health professionals interacting with athletes. While the main aim of the study was to profile the learning styles of different classes of athletes the authors feel that insight into the modality preferences of the health professionals involved would help to provide more effective implementation strategies.

5. Conclusions

As far as we are aware, this is the first independent study used to characterize athletes' learning preferences as a way to educate health professionals on appropriate methods of education. While further research is required for a more comprehensive understanding of the interaction between athletes and health professionals it is evident from our investigation that a trend exists between gender and athletic status and VARK learning style preferences. Therefore, these findings merit real life implementation. The findings from our investigation present the exciting opportunity for a paradigm shift in the way that athletes interact and communicate with health care professionals. Furthermore, this study should serve as a platform for further research in this field; the authors would recommend a simultaneous investigation into both athletes' and health professionals' learning style in order to gain better insight into how communication between the two parties and how such communication could be enhanced.

Acknowledgments

The authors would like to thank Avinesh Pillai from the University of Auckland, Department of Statistics, for his statistical advice, as well as the University of Auckland School of Medicine Foundation for funding technical support for the investigation.

Author Contributions

Andrea Braakhuis and Shawn Hueglin conceived and designed the research; Andrea Braakhuis, Shawn Hueglin, Elizabeth Fusco, Tea Williams, and Alex Popple performed the experiments; Tea Williams and Andrea Braakhuis analyzed the data; Andrea Braakhuis, Liz Fusco and Tea Williams wrote the paper.

Conflicts of Interest

The authors declare no conflict of interest.

References

1. Dunn, J.L. Using learning preferences to improve coaching and athletic performance. *J. Phys. Educ. Recreat. Dance* **2009**, *80*, 30–37.
2. Boyde, M.; Tuckett, A.; Peters, R.; Thompson, D.R.; Turner, C.; Stewart, S. Learning style and learning needs of heart failure patients (The Need2Know-HF patient study). *Eur. J. Cardiovasc. Nurs.* **2009**, *8*, 316–322.
3. Fuelscher, I.T.; Ball, K.; MacMahon, C. Perspectives on learning styles in motor and sport skills. *Front. Psychiatr.* **2012**, *69*, 1–3.
4. Leite, W.L.; Svinicki, M.; Shi, Y. Attempted validation of the scores of the VARK: Learning styles inventory with multitrait-multimethod confirmatory factor analysis models. *Educ. Psychol. Meas.* **2009**, doi:10.1177/0013164409344507.

5. Fleming, N. The VARK Questionnaire—For Athletes. In *VARK—A Guide to Learning Styles*; 2011. Available online: http://www.vark-learn.com/english/page.asp?p=athletes (accessed on 5 November 2013).
6. Fleming, N.; Bonwell, C. *How Do I Learn Best?: A Student's Guide to Improved Learning: VARK, Visual aural Read/Write Kinesthetic*, 1st ed.; Published by Fleming & Bonwell: Christchurch, New Zealand, 2001.
7. Fleming, N. Research & Statistics. *VARK—A Guide to Learning Styles.* Available online: http://www.vark-learn.com/english/page.asp?p=research. 2012 (accessed on 3 March 2014).
8. Choudhary, R.; Dullo, P.; Tandon, R.V. Gender differences in learning style preferences of first year Medical students. *Pak. J. Physiol.* **2011**, *7*, 42–45.
9. Slater, J.A.; Lujan, H.L.; DiCarlo, S. Does gender influence learning style preferences of first-year medical students? *Adv. Physiol. Educ.* **2007**, *31*, 336–342.
10. Wehrwein, E.A.; Lujan, H.L.; DiCarlo, S.E. Gender differences in learning style preferences among undergraduate physiology students. *Adv. Physiol. Educ.* **2007**, *31*, 153–157.