

# Survey of Canadian human anatomy courses in Kinesiology and Physical Education

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## SUMMARY

Human anatomy is a requirement for program accreditation from the Canadian Council of Physical Education and Kinesiology Administrators (CCUPEKA). Fifteen out of nineteen CCUPEKA accredited programs participated in a pan-Canadian environmental scan to determine if their human anatomy course would be classified as either regional, systemic or some combination of these two methods. Two additional raters from another university and with university anatomy teaching experience blindly rated each CCUPEKA accredited anatomy course based on a course syllabus. An intra-class correlation coefficient was calculated using the three raters to determine the reliability of such a classification system. Eight of fifteen professors classified their own course as a combination of regional and systemic anatomy. Three professors classified their course as regional and four classified their course as systemic. The reliability coefficient (ICC 2,k) was 0.48. Weak reliability is indicative of poor agreement on how each of the classification systems is defined. Future research should focus on agreement of a unified and accepted definition of these classifications. Then, more research can pursue the question of the best method to deliver this very important content to physical education and kinesiology undergraduate students.

**Key words:** Undergraduate anatomy – Regional anatomy – Systemic anatomy – Inter-rater reliability

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## INTRODUCTION

Human anatomy is a core class and a requirement of kinesiology and physical education programs across Canada. Specifically, the Canadian Council of Physical Education and Kinesiology Administrators (CCUPEKA) require human anatomy as one of their eight core classes to be considered for program accreditation for both their physical education and kinesiology streams (The Canadian Council of University Physical Education and Kinesiology Administrators). In this discipline, human anatomy is considered a pillar of undergraduate curriculum. While there have been a number of articles written on the evolution of the kinesiology and physical education profession (Elliot, 2007; Sage, 2013; Twietmeyer, 2012), few have focused on human anatomy. Despite the obvious value placed on the human anatomy content in undergraduate curriculum, there is a dearth of research examining the relevance of anatomy to the discipline, and in particular, a lack of evidence to guide effective delivery of anatomy content in this field. In order to improve anatomy education in Canada, research is warranted. The first logical step in this process is to elucidate and evaluate current trends in curriculum delivery. A recent article by Pais and Moxham (2013) provides a framework for evaluating content delivery in human anatomy. They asked the important question: Should gross anatomy be taught systematically or regionally? Pais and Moxham (2013) suggest that in order to improve anatomy education there is a need to understand the

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classification of undergraduate anatomy education as systemic, regional or both. Unfortunately, outside of this one paper posing the question, we are unaware of any other literature on this topic. Therefore, the purpose of this study was to complete a pan-Canadian environmental scan of undergraduate anatomy courses of CCUPEKA accredited programs to better understand how these courses are currently being delivered. Specifically we were interested in determining whether anatomy courses were delivered systemically, regionally, or a combination of the two.

## METHODS

A list of CCUPEKA accredited programs was obtained from the CCUPEKA website (The Canadian Council of University Physical Education and Kinesiology Administrators). Professors for each of the courses were contacted by electronic mail and asked if they were willing to participate in the study. Those interested in participating were asked to complete the survey (see Appendix). All 19 accredited programs were contacted and 15 decided to participate in the environmental scan. Professors were asked a number of questions related to the delivery or instruction of the course. One major question posed was the professors' classifications of the course into three categories: a) regionally based curriculum delivery; b) systemically based curriculum delivery; c) mixed regional and systemic curriculum delivery. Given that there are currently no consensus definitions for regional or systemic anatomy, no definitions were provided to study participants. Descriptive data on the 15 participating universities were calculated.

In order to determine reliability of rating a course systemically, regionally or mixed, course outlines (syllabus) for each of the participating institutions were also examined as part of the analysis. Based on the provided course outlines, the authors of this paper independently and blinded to each other, classified each university undergraduate anatomy course into three categories: a) regionally based curriculum delivery; b) systemically based curriculum delivery; c) mixed regional and systemic curriculum delivery. Authors were also blinded to the home professor's response. Authors of this paper were not given a pre-determined definition of systemic or regional anatomy prior to classifying each institution. An intraclass correlation coefficient (ICC 2,k) was employed to compare the three raters' classifications of the anatomy courses as a means of inter-rater reliability (2 authors of this paper and each individual instructor). All analyses were calculated using SPSS 17.0 ©.

## RESULTS

**Table 1.** Descriptive statistics for the frequency of anatomy classification from three raters.

Classification	Rater 1	Rater 2	Rater 3
Regional Anatomy Classification	2	5	3
Systemic Anatomy Classification	5	5	4
Combination of Regional and Systemic Anatomy Classification	8	5	8
Total	15	15	15

Descriptive statistics and classifications of courses into the three categories are listed in Table 1. Eight of fifteen professors classified their introductory anatomy course as a mixed regional and systemic curriculum delivery. Only three professors classified their introductory anatomy course as regionally based and four professors classified their introductory anatomy course as systemically based. The inter-rater reliability measurement (ICC 2,k) was .48 for the three raters.

## DISCUSSION

Data gathered from the individual professors from CCUPEKA accredited programs did not demonstrate a trend for teaching anatomy regionally, systemically or in combination. In fact, the process of classifying courses into three categories is not as straightforward as originally thought. The intraclass correlation coefficient (2, k) of .48 demonstrated weak reliability for this measure and classification system. Each rater has extensive background and expertise in the anatomy discipline, yet each seemed to have classified courses quite differently. The first step in future studies should be to agree on a classification of teaching anatomy regionally, teaching anatomy systemically or some combination of these two definitions. In order to guide this future research, we suggest using the definitions provided by Moore and Dalley (2006) for regional anatomy and Pais and Moxham (2013) for systemic anatomy, respectively:

"Regional anatomy (topographical anatomy) considers the organization of the human body as segments or major parts based on form and mass. Regional anatomy is the method of study the body's structure by focusing attention on a specific part (eg. the head), region (the face), or sub-region (the orbit); examining the arrangement and relationships of the various systemic structures (muscles, nerves, arteries, etc.) within it; and then usually continuing to study the adjacent regions in an ordered sequence" (Moore and Dalley, 2006, pg. 2).

Pais and Moxham (2013, pg. 2) defined systemic anatomy as

“anatomy of the systems of the body; an approach to anatomical study organized by organ systems emphasizing an overview of the systems throughout the body, and this involves a whole body methodology that would describe all organs and tissues for a particular system, to the virtual exclusion of other systems, and without recourse to precise locational parameters and the understanding of relationships between differing organs or tissues.”

It is possible that providing these definitions ahead of time may have changed the rating from each of the three raters. On the other hand, it may be that goals and objectives of the anatomy courses are unclear and ambiguous as Bergman et al. (2011) suggested. Either way, it may be important for a course that is core to the discipline and consistently taught across all kinesiology and physical education programs to possess content that is valid and agreed upon by experts.

Stephen Covey said we should “begin with the end in mind” (Covey, 1989). In the case of teaching undergraduate anatomy, the same principle should be applied. What is the end goal of teaching human anatomy in undergraduate kinesiology or physical education programs? Is there a distinction between those end goals for kinesiology versus the physical education disciplines? Should the content for majors within the kinesiology or physical education curriculum (such as a physical education teacher preparation or athletic therapy major) be the same? The anatomy topic has been studied with undergraduate medicine or healthcare professions, but there is a paucity of literature related to undergraduate anatomy in the kinesiology and/or physical education disciplines. As a result of these unanswered questions, one is left to speculate on the purpose of undergraduate anatomy in the kinesiology and physical education discipline. A logical speculation would be to analyze which courses require anatomy as a prerequisite.

Anatomy is commonly a prerequisite to variety of courses, including biomechanics. Biomechanics is a course that informs a fundamental principle in

the kinesiology and/or physical education discipline: “understanding the anatomic, physiologic and mechanical phenomena which underlie the performance of motor skills” (Hoffman, 1977, pg 39). Anatomy is at the core of understanding and analyzing human movement and physical literacy with a normally functioning person. Biomechanics is one course that teaches the foundations of these analytical skills required for physical education teachers and human anatomy is a foundation to the biomechanics content.

Hamill (2007) attempted to put the biomechanics course (also a core class in the kinesiology or physical education discipline) into context in an undergraduate curriculum. In doing so, he also highlighted the importance of human anatomy, first, as a building block to success in the biomechanics outcomes. However, of the nine items (Table 2) he highlighted as having an anatomical basis of importance for building understanding in biomechanics, five of them are related to human physiology, exercise physiology or the muscular system. Therefore, it may be important to discern between the concepts in a human anatomy and human physiology course when deciding on the outcomes of a course.

Another course commonly found in kinesiology and physical education curricula is the “prevention and care of athletic injuries” although it likely has a variety of different names across North America. This course typically lists human anatomy as a prerequisite. Human anatomy acts as the foundation to understanding the human body that has defects, disease or suffers from trauma (Miller et al., 2002). Regarding the ‘prevention’ component of this course, human anatomy and biomechanics are critical to understanding both normal and abnormal function. For example, a knee injury prevention program for soccer has been developed by FIFA (The Federation Internationale de Football Association, 2011). Specifically, one of the exercises in this knee injury prevention program requires an observer (i.e. coach, physical educator and/or athletic therapist) to identify abnormal knee valgus

**Table 2.** Nine prerequisite concepts that have an anatomical basis (Hamill, 2007, pp. 26-27).

Item #	Prerequisite Concept
1	Identify and describe joint actions, axes of rotation and planes of movement in simple single joint activities and more complex multi-joint motor performances.
2	Observe human movement and explain the reasons for different joint actions and ranges of motion using knowledge of joint structure, stability and mobility.
3	Assess flexibility and create safe and effective stretches for the major muscle groups surrounding each joint.
4	Identify and describe the roles that muscle groups play and their cooperative actions during simple joint activities and complex multi-joint motor performances.
5	Explain the force-velocity and length-tension relationships of muscle and recognize their application in static positions and dynamic movements.
6	Recognize the use of the stretch-shortening cycle of muscle in human movement and create effective training exercises that utilize this phenomenon.
7	Describe the mechanical response of different muscle fiber types, the influence of training upon them, and the potential for muscle fiber type to influence performance.
8	Define the basic structures of the neuromuscular system and explain how reflexes affect human movement.
9	Describe how rate coding of motor units regulate muscle force production.

(i.e. where knee drops abnormally to the inside of their body). Once again, normal anatomy and function is fundamental to being able to correct abnormal movement, and thus prevent injury. Anatomy is also foundational to returning the body to normal function after injury or disease, as is the case in rehabilitative settings. Some of these 'prevention' and 'care' of athletic injuries are introduced in the "prevention and care of athletic injuries" course offered in most undergraduate kinesiology and physical education curricula. Human anatomy is an extremely important foundation to this course content.

In summary, we have provided an example of two courses commonly found in an undergraduate kinesiology or physical education curriculum: biomechanics and prevention and care of athletic injuries. These are but two of many courses in kinesiology and physical education curricula that may require human anatomy as a prerequisite. An examination of the core curricular outcomes in courses such as these may guide curriculum development and standardize anatomy course content. Further research is warranted to examine these outcomes with the goal of effectively focusing anatomy curriculum in the kinesiology and physical education field.

Another method for standardizing and focusing the anatomy curriculum, and the focus of the current paper, is to examine methods of content delivery. Moving forward, there is a need to determine the best mechanism to teach and assess anatomy content: regionally, systemically or some combination of these two. Results of the current paper suggest that there is lack of consistency among Canadian undergraduate kinesiology and physical education programs with respect to delivery type. There is a need to examine the risks and benefits of each approach. This examination could be guided, as suggested above, through adoption of common definitions of systemic vs. regional approaches. As a starting point for this line of examination, Pais and Moxham (2013) presented an excellent case of the benefits and drawbacks of both regional and systemic methods. Seemingly, it would appear that systemic approaches are very well suited to preparing physicians or in medical education. Specifically, teaching systemically would provide a strong basis for identifying clinical pathology through the various organs that may be involved. However, this method does not seem well suited to some specialties such as radiology, physical medicine, orthopedic surgery or general surgery (Pais and Moxham, 2013). Pais and Moxham (2013) also claim that it would be difficult for those students who have learned through a systems-based approach to apply this knowledge into a regional anatomy context. Pais and Moxham (2013) postulate that the most beneficial impact of teaching anatomy regionally is the translation into three-dimensional thinking for students. Thus, students

can understand and appreciate the relationship of anatomical parts to one another. The most significant drawback of teaching anatomy regionally is that it may not fit into a traditional clinical model of medicine. When considering the type of anatomy course design, one suggestion from medical students is that a stand-alone course in human anatomy is beneficial prior to jumping right into an 'integrated' course that focuses more on disease than the underlying structures of that disease (Moxham and Plaisant, 2007; Moxham et al., 2011; Pais and Moxham, 2013). Pais and Moxham (2013) conclude that anatomy should be taught regionally, but if time permits, both regionally and systemically. However, there is little evidence to support teaching one way or the other. Only future research will help an understanding of this question more for the kinesiology and physical education discipline.

In conclusion, results of the present study suggest that there is a lack of consistency in content delivery methods for human anatomy in kinesiology and physical education programs in Canada. This inconsistency could be related to the lack of common definitions for systemic and regional anatomy, or to actual differences in delivery methods. Either way, there is a need to further examine and improve human anatomy delivery in this field. This could be guided through examination of curricular goals and outcomes of courses requiring human anatomy as a prerequisite, and through further research into content delivery methods. Studies of content delivery should be focused through use of common definitions for systemic and regional anatomy approaches.

#### ACKNOWLEDGEMENTS

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#### REFERENCES

- BERGMAN E, VAN DER VLEUTEN C, SCHERPBIER A (2011) Why don't they know enough about anatomy? A narrative review. *Med Teach*, 33: 403-409.
- COVEY S (1989) *The seven habits of highly effective people; powerful lessons in personal change*. Free Press, New York.
- ELLIOT D (2007) Forty years of kinesiology: A Canadian perspective. *Quest*, 59: 154.
- HAMILL J (2007) Biomechanics curriculum: Its content and relevance to movement sciences. *Quest*, 59: 25.
- HOFFMAN S (1977) Toward a pedagogical kinesiology. *Quest*, 28: 38.
- MILLER S, PERROTTI W, SILVERHORN D, DALLEY A, RAREY K (2002) From college to clinic: reasoning over memorization is the key for understanding anatomy. *Anat Rec*, 269: 69-80.
- MOORE K, DALLEY A (2006) *Clinically oriented Anato-*

my. (5<sup>th</sup> ed.). Lippincott, Williams and Wilkins, Philadelphia.

MOXHAM B, PLAISANT O (2007) Perception of medical students towards the clinical relevance of anatomy. *Clin Anat*, 20: 560-564.

MOXHAM B, SHAW H, CROWSON R, PLAISANT O (2011) The future of clinical anatomy. *Eur J Anat*, 15: 29-46.

PAIS D, MOXHAM B (2013) Should gross anatomy be taught systemically or regionally? *Eur J Anat*, 17: 43-47.

SAGE G (2013) Resurrecting thirty years of historical insight about kinesiology: a supplemental to "what is kinesiology? Historical and philosophical insights". *Quest*, 65: 133.

The Canadian Council of University Physical Education

and Kinesiology Administrators. *Kinesiology accredited programs*. Retrieved June 2, 2012, from <http://www.ccupeka.ca/en/index.php/accreditation/19-institutions-and-procedures/11-kinesiology-institutions>

The Federation International of Football Association (2011) *FIFA 11+ : A complete warm up program*. Retrieved May 1, 2013, from <http://f-marc.com/11plus/home/>

TWIETMEYER G (2012) What is kinesiology? Historical and philosophical insights. *Quest*, 64: 4.

## APPENDIX The Survey

Institution:  
Professor's name:  
Professor's phone number:  
Professor's e-mail:  
Date:

*Thank you for taking the time to complete our environmental scan! The goal of this questionnaire is to understand what methods and approaches to teaching human anatomy are the most widely employed in CCUPEKA accredited programs. It should take approximately 10 minutes to complete.*

### What type is your degree program?

Kinesiology  
Physical Education and Recreation  
Human Kinetics  
Exercise Science  
Other

### How many students are registered in the anatomy course?

1-50; 51-100; 101-150; 151-200; Greater than 200.

### Which approach is used in structuring your anatomy course?

Systemic; Regional; Combination.

### Why have you chosen this approach?

### Do you combine anatomy and physiology in one course?

Yes; No.

### Why?

### Which of the following do you use in your lecture:

Power point slides; Group work; Interactive activities  
Models; Computer based tolos; Blended learning  
(online learning); Other:

**Do you provide students with lecture notes? If yes, in what format?** Course pack with full notes; Course pack with incomplete notes; No

### Which of the following do you use in your lab?:

Cadaver; Full dissection; Prosections; # of students per cadaver; Models; 3-D Images; Interactive online tolos; Microscopes; Animal Models; Other:

**Do you have an anatomy study centre? If so, what resources are there?**

**How many hours per week lecture?**

**How many hours per week lab?**

**Is additional study time in the lab expected beyond normal lab times?**

**What textbook are you using?**

Title; Author.

**Is the text book mandatory or suggested?**

**Do you have suggested/optional textbooks? If yes, what are they?**

**What lab manual are you using?**

Institution written and printed; Other: Title; Author.

**Which of the following programs are you aiming to prepare students for:**

Physical Therapy; Occupational Therapy; Medicine  
Athletic Therapy; Massage; Other.

**Could you please email a course syllabus to us?**

*Thank you for your help!*