Active learning in the classroom: a muscle identification game in a kinesiology course

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McCarroll ML, Pohle-Krauza RJ, Martin JL. Active learning in the classroom: a muscle identification game in a kinesiology course. Adv Physiol Educ 33: 319–322, 2009; doi:10.1152/advan.00013.2009.—It is often difficult for educators to teach a kinesiology and applied anatomy (KAA) course due to the vast amount of information that students are required to learn. In this study, a convenient sample of students (class A) from one section of a KAA course played the speed muscle introduction and matching game, which is loosely based off the premise of the adult game of “speed dating.” The game involves student’s taking on a “muscle” personality when introducing themselves to potential mates. The experimental group (class A) played the game at two time points throughout the semester after a series of lectures focusing on the body’s muscles. A control group (class B) from another section of the KAA course still received the series of lectures but did not play the games throughout the semester. A postgame questionnaire given to class A revealed the following scores: 1) overall perception of the game (score: 4.43 ± 0.68), whether goals and objectives were met (score: 4.05 ± 0.67 to 4.95 ± 0.22), and perceptions of the organization of the game (score: 3.81 ± 0.81 to 4.48 ± 0.60). Overall, the game was well received by class A. When evaluating outcome scores of final grades between the two groups, class A improved final grades by 5.82% for a mean grade of 79.52 ± 10.0; however, the final grades were not statistically significant (P > 0.05) compared with class B (73.7 ± 15.6). The results show that an interactive game may contribute to improved final grades in a KAA course and could be an alternative means of disseminating kinesiology information.

functional anatomy

MANY BARRIERS ARE OFTEN ENCOUNTERED by educators when trying to successfully teach a kinesiology and applied anatomy class. These barriers may include 1) the vast amount of material that must be covered, 2) the student’s time constraints, 3) the increased use of technology-based programs that may not meet the learning needs of all students, and 4) the fact that students lose sight of the need to immerse themselves in the material instead of just memorizing it.

It can be challenging to present muscle properties in a way that is interesting and less repetitious. Memorizing muscles and their functions encompasses a large amount of difficult information with a limited number of ways in which to relay that information. In addition to learning the names of muscles and their functions, students need to understand the impact of muscle contraction on functional movement. Students may become disengaged and decide to take a more rote approach to learning muscles and lose site of the functional implications involved. Therefore, students may not see the need to dive into the subject material and look at it from many different angles.

In addition to teaching a difficult subject, educators must compete with the everyday pressing demands of their student’s lives (1). Today’s students have family, work, and community responsibilities that act as distractions that might otherwise be used for study (1). Therefore, students may prefer to memorize muscles and their functions instead of taking the time to study the impact on function and disease.

In our technology-dependent society, younger students are looking to be entertained in the classroom (1). Technology/computer-based programs are now used as supplements in assisting students to learn anatomy and kinesiology concepts. Computer-based programs often include the use of three-dimensional models and video games. These programs offer many benefits, including conveying information to a large group of students, reducing the need for small laboratory classes, needing less equipment, containing costs, and providing an opportunity for students to learn within their own time and place requirements (3). Computer-based programs can, however, remove students from personal interactions/discussions/practical applications with their fellow classmates and teachers (3).

For students in allied health profession programs, the ability to learn and recall several muscle names and their origins, insertions, and actions are perceived by students and some teachers as time consuming, difficult, and mundane. Allied health programs include, but are not limited to, exercise physiology, athletic training, and physical and occupational therapy.

However, difficult the task of learning anatomy and kinesiology, it is the basis for understanding how body systems work, how the body is impacted by disease and injury, and how to develop and choose appropriate treatment plans. While anatomy is often seen as a game of memorization, the most important reason to learn anatomy is to be able to recognize normal structure and its role in producing normal function (1).

There have been previously published articles on anatomy and physiology games to improve active learning in the classroom, but there is no published information on active learning games specifically applied to a kinesiology-based course (5). Odenweller et al. (5) reported that basic card games adapted to physiology were very successful and fun in reviewing gastrointestinal track functioning with “Go GI” for a version of “Go Fish” and “Gastrointestinal Rummy” for a version of “Gin Rummy” (5).

This article describes the development and use of an active and interactive muscle identification game used in class to supplement and reinforce anatomy and kinesiology lectures.
METHODS

**Speed Dating: the Speed Muscle Introduction and Matching Game**

The game is loosely based off the premise of the adult game of “speed dating” (6). The game involves students taking on a “muscle” personality when introducing themselves to potential mates. Students assume the personality of the muscle that is listed on the name card attached to the lanyard.

**Rules.** Two rows of desks or tables are set up in the classroom with students on each side facing one another. The setup is similar to the setup one might see at a speed dating function. Students are instructed to sit at the desks facing a fellow student. Each student is given a name tag with the muscle identity that they are to portray. On the front of the name tag is the name of a muscle (Fig. 1). On the back of the name tag is the description of the muscle’s origin, insertion, and action and an example of a functional exercise specific to that muscle (Fig. 2). The name tags are passed out randomly and highlight sections covered in the book using functional anatomy of the upper extremity muscles, lower extremity muscles, or trunk muscles (4). The students have 2 min to introduce themselves, acting as the muscle personality to the student across from them. The students introduce their muscle name and then go through the information on the back of the card. After 2 min, one row of students stands up and moves down a seat. The introductions are repeated again for 2 min. The shift down is repeated again until all of the students have had an opportunity to meet every one of their classmates. After the speed dating function, the students are instructed to stand up and mingle with their fellow muscles and find their perfect match, which is the antagonist to their primary muscle movement. Once couples (agonists and antagonists) are matched, the students present as a muscle couple in front of the class to reveal their muscle identities and demonstrate their muscle actions. The game has been broken up for the demonstration of lower body muscles below the pelvic axis, and another game would take place for upper body muscles above the pelvic axis. At the end of the game, students have been introduced to upper extremity, lower extremity, and trunk muscles.

**Supplies.** The names of the muscle can be created using printable name tags with the lanyards found at many national office supply stores. The cards are created using template programming in the user’s word-processing format and typing in the variations of muscle names and properties. One side of the lanyard name card indicates the muscle’s name. The other side of the lanyard name card indicates the following: 1) where are you from? (i.e., the insertion of the muscle); 2) where do you work? (i.e., the origin of the muscle); 3) what do you do for a living? (i.e., the action of the muscle); and 4) what do you like to do for fun? (i.e., a movement/exercise that strengthens/uses the muscle).

**Sample**

*Experimental group: class A.* Twenty-one students in a Kinesiology and Functional Anatomy course played the speed muscle intro-
duction and matching game. The games were played at two time points during the semester. Time point 1 for playing the game was during the section on the lower body muscles below the pelvic axis. The lower body version of the game was played after a series of lectures on the lower body muscles and was intended to reinforce the lecture concepts covered in class. The game was played during a typical classroom session after a short review lecture focusing on the lower body muscle groups. Time point 2 for playing the game was during the section on the upper body muscle groups above the pelvic axis. The upper body version of the game was played after a series of lectures on the upper body muscles and was intended to reinforce the lecture concepts covered in class. The game was played during a typical classroom session after a short review lecture focusing on the upper body muscle groups.

Control group: class B. The control group had 19 students enrolled in another section of the Kinesiology and Functional Anatomy course. These students were provided the same series of lectures as class A on the lower and upper body muscle groups. Class B was not provided the opportunity to play the speed muscle introduction and matching game at any time point during the semester.

Statistics

Statistical analyses were performed using the statistical package SPSS 15.0 for Windows (SPSS, Evanston, IL). Descriptive data with mean ± SD scores were reported for class A on the questionnaire evaluating the speed muscle introduction and matching game. An independent sample t-test was performed with assumed equal variances with normal distribution to evaluate the mean final grade scores of class A versus class B. Values of P < 0.05 were considered statistically significant.

RESULTS

Class A was composed of 21 students with a mean age of 22.8 ± 2.4 yr with 14 males and 7 females. Twenty students indicated having previously taken a basic anatomy and physiology course, whereas only one student indicated no history of a previous anatomy and physiology course. Class A students were given a Likert-scale questionnaire after playing the speed muscle introduction and matching game after time point 2. The Likert-scale questionnaire was adapted from a previous publication by Odenweller et al. (5) for Go GI and Gastrointestinal Rummy. The questionnaire revealed that the goals and objectives of the muscle game met the student’s expectations with a mean range of 4.05 ± 0.67 to 4.95 ± 0.22 (Table 1). The organization of the game ranged from 3.81 ± 0.81 to 4.48 ± 0.60 (Table 1). The overall score of the perception of the muscle game was 4.43 ± 0.68 on a 5-point scale (Table 1). Most students agreed that the muscle game was a good review and emphasized key points from the functional anatomy lectures. One student from class A did not have a previous anatomy and physiology class, which provided information that a base knowledge of anatomy is helpful in understanding the content on the cards for the muscle game.

Class B (the control group) had 19 students enrolled in the course with 7 males and 12 females. Class B did not have the opportunity to play the muscle game any time point throughout the semester.

As a result, class A improved final grades by 5.82% for a mean grade of 79.52 ± 10.0; however, the final grades were not statistically significant (P > 0.05, T1.43, 84% confidence level) compared with class B (73.7 ± 15.6; Table 1). A mean score of 71.2 for class B or 82.1 for class A would have been necessary to provide a statistically significant difference with a 95% confidence level for the sample size evaluated.

DISCUSSION

This game was developed to establish an active learning atmosphere, which is essential in understanding kinesiology and functional anatomy. The positive results found in this project are similar to the other published games used by Odenweller et al. (5). The game encouraged students to interact, demonstrate muscle movements, and find the antagonist to their muscle personality. The project was initiated to present muscles in a different format than the typical PowerPoint presentation, computer-generated graphics, and simple memorization charts. The curriculum in exercise science and physical education is similar to other health professions requiring similar kinesiology/biomechanics coursework. The results show that the game can be effective for different majors yet follow similar patterns of curriculum requirements.

After the game, the students learn the names of muscles and their function through repetition, demonstrations, and interactions with fellow classmates. The students do not just learn the names of muscles and their function but also the planes of motion and how they relate to functional activities. The students are removed from the traditional classroom lecture and are able to participate in an activity that is related to a social activity. The activity is fun and provides visual, physical, and

<table>
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<tr>
<th>Table 1. Class A questionnaire results and group comparisons</th>
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<tr>
<td><strong>Goals and objectives</strong></td>
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<tr>
<td>1. The purpose and rationale for the game were fully explained.</td>
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<td>2. The goals and objectives of the game were clearly defined.</td>
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<td>3. The game emphasized key points of muscle knowledge and kinesiology.</td>
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<td>4. The game was thought provoking.</td>
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<td>5. The game encouraged student interaction.</td>
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<td>6. The game promoted discussion of muscles.</td>
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**Components and organization**

1. The directions were clear, concise, and easily understood. | 3.81 ± 0.81 |
2. The length of time required to play the game was reasonable. | 4.48 ± 0.60 |
3. Playing the game was fun. | 4.30 ± 0.78 |
4. I would recommend the game to my peers. | 4.30 ± 0.72 |
5. Overall rating. | 4.43 ± 0.68 |

**Summary and recommendations**

- Class A final grade | 79.52 ± 10.0 |
- Class B final grade | 73.7 ± 15.6 |

Values are means ± SD. Students responded to the following directions: “The following statements evaluate specific components of the game on a scale of 1 to 5. Circle the number that most accurately defines the way you feel regarding each statement.” The scale was as follows: 1, strongly disagree; 2, tend to disagree; 3, neither agree nor disagree; 4, tend to agree; and 5, strongly agree. The final grades for class A and class B were not statistically significant. [The questionnaire was reprinted with permission from Ref. 5.]
verbal associations that students may remember when recall is necessary. The anatomy information is not only taught by the class instructor but is relayed by fellow students. The students play an active role instead of a passive role, as is often seen in a kinesiology and functional anatomy classroom.

Limitations to the results of the muscle game project include the limited number of students, their previous base knowledge of anatomy and physiology, and the fact that the game was applied only once with the same muscles in the semester. The muscle game may provide more effectiveness if used in conjunction with other teaching methods and if it is played more throughout the semester. Learning difficult content over time or more often throughout the semester has been shown to be more effective (1). According to Amato et al. (1), current athletic training programs are required to teach the students in the athletic training program over time to improve student-related outcomes.

The authors hope the muscle game demonstrates a teaching and learning style amenable to students in any health profession major and at any age group. In addition to other adjunctive course work, the muscle game combines multiple senses, including listening, speaking, vision, and the physical application of a large amount of content in a fun way. Furthermore, depending on the depth of the course, the game can divide the body up even more to cover a larger amount of muscle content. More studies are needed to evaluate the role of active learning in the health sciences to encourage success in the classroom.

DISCLOSURES

All authors have read and approved submission of the manuscript, and the manuscript has not been published and is not being considered for publication elsewhere in whole or part in any language except as an abstract. There are no disclosures of financial interest or conflicts of interest.

REFERENCES