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COACHING EDUCATION

Comparing Sport Coaches' and Administrators' Perceptions of the National Standards for Sport Coaches

David P. Hedlund, Carol A. Fletcher, Sean Dahlin

Abstract

The purpose of this study was to examine perceptions of sport coaches and administrators regarding the eight domains and 40 standards contained in the National Standards for Sport Coaches (NSSC). Data were primarily obtained from junior high school, high school, and college-level sport coaches (n = 308) and sport administrators (n = 99) in the United States. The results indicated that sport coaches and administrators believe the 40 standards are important to effective coaches. The results also showed that sport coaches and administrators rank the importance of the eight domains with a high degree of similarity. These results represent a timely, multisample examination of the NSSC, and the results of this research help to ensure that coaching education is aligned with the current perceptions and needs of sport coaches and administrators. The results of this research also can be used as a starting point for upcoming revisions to the NSSC.

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Sport coaching education in the United States is offered by many colleges and universities nationwide and nearly every sport governing body (e.g., U.S. Soccer, USA Baseball, the National Federation of State High School Associations) on a multitude of topics (e.g., how to coach, what to coach in a particular sport, health issues sport coaches face [e.g., concussions, nutrition, performance-enhancing drugs). Over the last 30 years, through creating, updating, and disseminating the National Standards for Sport Coaches (NSSC; National Association for Sport and Physical Education [NASPE, 2006), sport and physical education scholars, practitioners, and coaching leaders have put forward a detailed list of topical areas in which sport coaches should be knowledgeable to be effective. Although sport coaches have access to a diverse array of coaching education resources, in each sport and at different levels of coaching, unique guidelines and requirements have led to the creation of independent systems of sport coaching education. For example, U.S. Soccer (n.d.) offers six licenses beginning with an F license and moving to an A license. The course progression aligns with the developmental stages of athletes (F = Under-6 to Under-8 years old, A = Under-19 years old and older). In contrast, in 2015, USA Baseball (2015) first began offering four content-based courses (The Confident Baseball Coach, The Play Ball Parent, Introduction to Umpiring, and Introduction to Pitch Smart) online. Thus, although U.S. Soccer has been offering formal coaching education for more than 2 decades, until recently, baseball coaches had no formal baseball-specific coaching training offered by USA Baseball. The differences between how U.S. Soccer and USA Baseball provide coaching education highlight just a few of the differences between how coaches in different sports are trained in the United States.

Stakeholders and leaders representing over 140 sport organizations at all levels (e.g., youth to adult, Olympic, Paralympic) and types of sports created the NSSC in an attempt to meld, organize, and bring consistency to the multitude of sport coaching education offerings. Although the NSSC lists 40 specific sport coaching standards grouped into eight defined content domains, most sport coaches are unaware that the NSSC even exists. Since the first coaching standards were produced in 1984, approximately every 10 years, the standards have been reviewed and updated. The last update to

the NSSC occurred in 2006, and the introduction of new coaching requirements and issues related to child and athlete protection, health issues sport coaches face (e.g., concussions, nutrition, performance-enhancing drugs), the use of technology and analytics in sport, and enhanced sport training methodologies suggests that the NSSC is ripe for reexamination.

While sport scholars and coaching leaders continue to discover and advance the best practices of sport coaching, education, and training, further examinations and comparisons of how multiple stakeholders perceive current sport coaching education practices is warranted before future updates can be made to the NSSC. Sport coaches (e.g., online educators, international and overseas educators) increasingly have the ability to undertake sport coaching education almost anywhere courses are offered, and the diverse coaching education practices of local, national, and international sport organizations have created unique challenges (i.e., each U.S. state has unique coaching requirements [Gilbert, Côté, & Mallett, 2006], whereas in Canada since 2005, every national sport organization has adopted Canadian Sport for Life and long-term athlete development model principles to govern sport coaches' training and education [Norris, 2010]). For the process of identifying the most important areas and practices of sport coaching education to continue, research must be undertaken that helps coaching educators identify topical areas on which coaching education should focus. Sport coaches cannot invest unlimited resources all at once into their sport coaching education, so knowing and understanding the most important topical areas in which they must be educated and proficient would be extremely helpful to coaches wishing to maximize the effectiveness of their coaching education. After the most important areas of sport coaching education are identified, the sport coaching education process can be improved through the creation of relevant courses and educational modules in the identified areas. Finally, because sport coaches are not the only stakeholders within sport coaching education, examining multiple perspectives will provide a more complete understanding of what the sport coaching education process should include. Educating and developing effective sport coaches must be a high priority for sport organizations and educational institutions (e.g., colleges and universities), because the health and welfare of

athletes in their care should not be put in jeopardy by untrained and/or ineffective sport coaches at all levels of sport.

Literature Review

Sport coaching has been defined as "a process of guided improvement and development in a single sport and at identifiable stages of athlete development" (International Council for Coaching Excellence, Association of Summer Olympic International Federations, & Leeds Metropolitan University, 2013, p. 14). The effectiveness of a sport coach is judged by internal (e.g., supervisors and coworkers) and external (e.g., parents, fans, and media) stakeholders, and their evaluations are based on quantitative (e.g., numbers of wins, losses, and championships) and qualitative (e.g., perceived personal growth in the maturity of athletes) factors. Quantitative factors have often been the focus of coaching evaluations, but recently scholars have advanced the position that coaches' effectiveness should be judged on a multitude of integrated factors. Côté and Gilbert (2009) noted this point when they defined coaching effectiveness as "the consistent application of integrated professional, interpersonal, and intrapersonal knowledge to improve athletes' competence, confidence, connection, and character in specific coaching contexts" (p. 316). In other words, being an effective coach is not just about winning and losing, but rather it consists of improving and mastering a number of skills and abilities that coaches can use to help athletes develop physically, socially, mentally, and emotionally (Coakley, 2015; Gilbert, Nater, Siwik, & Gallimore, 2010). Scholars and practitioners have also proposed multiple strategies that sport coaches can undertake to become effective coaches.

Recently, detailed descriptions of how, where, and from whom sport coaches learn how to be an effective sport coach have emerged from the sport coaching education literature (Côté, 2006; Côté & Gilbert, 2009). In addition to attending and completing traditional coaching education courses at educational institutions, sport coaches can learn how to coach sports from (1) coaching certification programs; (2) clinics and seminars; (3) mentoring; (4) books and videos; (5) interactions with other coaches; (6) Internet resources; and (7) personal experiences based on playing, coaching, and watching sports (Wright, Trudel, & Culver, 2007). Despite the multiple sources for sport education, it is not well understood what coaches

should be studying during their sport coaching education and how coaching education experiences fit together in the process of helping all coaches reach their highest potential (i.e., becoming an effective [expert coach). Moreover, because of the unique responsibilities and perspectives of those with different roles and responsibilities within a sport organization, there may be disagreements between, for example, sport coaches and sport administrators about the essential areas in which sport coaches should undertake continuing sport coaching education. Because a sport administrator usually has the power to hire and fire the sport coach, but not vice versa, it would be beneficial for sport coaches to understand what areas of sport coaching education are valued by their supervisors.

Since the beginning of competitive sport and the advent of coaching athletes, there has been a spirited debate about what constitutes an effective sport coach (Côté, Young, North, & Duffy, 2007). To answer this question, scholars have examined a multitude of factors, including the ability to teach technical skills, communicate well with athletes and parents, motivate athletes well, make good decisions, handle pressure well, understand and utilize good game strategies and tactics, and build and strengthen an athlete's character (Feltz, Chase, Moritz, & Sullivan, 1999; Park, 2004). To date, three important conceptual models have been developed. Each discusses in detail the factors that make up coaching effectiveness and the relationship that effective coaches have with other important sport coaching outcomes.

Coaching Effectiveness

As mentioned, coaching effectiveness is defined as "the consistent application of integrated professional, interpersonal, and intrapersonal knowledge to improve athletes' competence, confidence, connection, and character in specific coaching contexts" (Côté & Gilbert, 2009, p. 316). Prior to Côté and Gilbert's (2009) research, Côté, Salmela, Trudel, Baria, and Russell (1995) created one of the first coaching effectiveness models. They identified six factors (i.e., competition, training, organizational factors, the coach's personal characteristics, the athlete's personal characteristics and level of development, and contextual factors) that could impact whether a person became an effective coach. Horn (2002) created another

model of coaching effectiveness. This model focused on the effects of sociocultural context, organizational climate, and coaches' personal characteristics that may be mediated through coaches' expectancies, values, beliefs, and goals. Horn posited that situational and individual variables affect coaching effectiveness behaviors. Finally, Côté and Gilbert proposed that coaches' knowledge (i.e., professional, interpersonal, and intrapersonal), athletes' outcomes (i.e., competence, confidence, connection, and character/caring), and coaching contexts (i.e., participant or performance coaching) are important principles that evaluators need to consider when examining and measuring coaching effectiveness. As the coaching effectiveness literature developed, the Society of Health and Physical Educators (formerly known as the American Alliance for Health, Physical Education, Recreation, and Dance) and the National Committee for Accreditation of Coaching Education created the National Standards for Sport Coaches to guide and assist sport coaches, sport administrators, and sport coaching educators in creating educational materials to educate sport coaches at all levels and with different sets of experiences, knowledge, proficiencies, and effectiveness.

National Standards for Sport Coaches

In 1984, the National Association of Sport and Physical Education (NASPE) published a position paper on the Standards for Youth Sport Coaches (Bodey, Brylinsky, & Kuhlman, 2008). Later in 1995, the National Standards for Athletic Coaches were created through collaboration between more than 140 local, state, and national sport governing bodies in conjunction with NASPE (Brylinsky, 2002). These standards identified the "scientific and practical competencies that administrators, athletes and the public should expect of sport coaches at various levels of experience" (NASPE, 1995, p. 3). In 2006, an expanded group of collaborators and stakeholders renamed the National Standards for Athletic Coaches to the NSSC, edited existing standards, added three new standards, and added new information about benchmarks that coaches should achieve as they progress from novice to expert. Specifically, the NSSC consists of eight domains and 40 standards that explicate the "direction for coaching educators, sport administrators, coaches, athletes and their families, and the public regarding the skills and knowledge that coaches should

possess" (NASPE, 2006, p. 3). Currently, the NSSC is the most complete sport coaching framework for developing sport coaching education criteria in the United States.

The first of eight domains in the NSSC is titled Philosophy and Ethics, and it focuses on creating an athlete-centered coaching philosophy, professional accountability, and fair play by all. Safety and Injury Prevention is the second domain, and it highlights the coach's responsibility for providing safe conditions, following emergency protocols when necessary, having basic sport medicine knowledge, and creating and maintaining a safe and healthy sport experience for athletes. The third domain, Physical Conditioning, focuses on coaches' responsibilities in the areas of designing and implementing conditioning programs, understanding overtraining, prevention and recovery from injuries, physiological training, and administering nutrition and drug education. Domain four, Growth and Development, centers on identifying developmental considerations in designing practice and competition to enhance the physical, social, and emotional growth of athletes. This domain is also related to creating an inclusive learning environment that leads athletes to feel welcome and supported and to have experiences that foster leadership skills. The fifth domain, Teaching and Communication, focuses on identifying standards for sound instructional strategies and the interpersonal behavior of the coach, creating a positive coaching style while maximizing learning and enjoyment, and individualizing instruction. Emphasis is also placed on empowered communication and management skills, developing self-motivated and satisfied athletes, and mitigating bullying and harassment on a team. Titled Sport Skills and Tactics, the sixth domain of the NSSC is based on coaches acquiring and applying basic sport knowledge to competitive situations, developing team and individual tactics, and making personnel decisions during practices and games. Coaches are also expected to utilize age-appropriate practice plans that are sequential and progressive and to define expectations for scouting and game analysis. The seventh domain, Organization and Administration, focuses on how coaches expend their resources in the daily operation and management of their sport program, including effectively using human and financial resources while undertaking administrative duties. This domain also includes ensuring that coaches under-

stand their basic risk management responsibilities. The final domain is Evaluation, which highlights the assessment skills necessary to be an effective coach, including personnel selection, evaluating practice effectiveness and an athlete's progress toward defined goals, game management skills, program evaluation, self-reflection activities, and professional growth opportunities. Although a diverse group of leaders, stakeholders, and constituents took part in creating the position paper (1985), the first version (1996), and the second version (2006) of the NSSC, to date there is a lack of research regarding how sport coaches and sport administrators feel about the importance of the eight domains and 40 standards relative to being an effective sport coach.

As a result, the purpose of this research is threefold. First, sport coaches' and sport administrators' opinions about what effective sport coaches need to learn in sport coaching education programs is examined. The 40 standards contained in the NSSC will be used as the basis of the first examination. The standards are the most specific and expansive list of specific competencies that sport coaches in the United States should meet. Second, because of coaches' limited resources (and their inability to study everything all at once), the opinions of sport coaches and sport administrators will be examined regarding which of the eight domains are the highest priority areas for effective sport coaches to study. When resources (e.g., time, energy, money) are scarce, sport coaches need guidance about which topical areas are of highest importance and priority to allocate for their continuing education. In addition, local, state, national, and international sport governing bodies and related groups that produce and publish coaching educational materials would be well served to know the topical areas that are perceived as most important. As a result, education providers of coaching materials could produce appropriate resources needed by sport coaches. The third and final purpose of this research is to compare the results for the 40 standards and eight domains between sport coaches and sport administrators to determine if any significant or important differences exist between the two groups. Because of the fundamental differences in the purposes of their role within the sport organization, sport coaches and sport administrators often do not see eye to eye on a variety of issues (Bowen & Levin, 2003; Shulman & Bowen, 2001).

When it comes to the necessary knowledge and skills needed, sport coaches and sport administrators should be on the same page. The results of this research will shed light on perceptions of the NSSC and whether sport coaches and sport administrators similarly perceive the importance of the eight domains and 40 standards to effective coaches. The next section will describe the methods in detail.

Method

Participants

Before this study was undertaken, institutional approval was received. Potential participants were informed of this research through information posted on sport coaching groups' social media web pages (e.g., LinkedIn). Word-of-mouth announcements and information about the research were also provided to those directly affiliated with the authors, and website and e-mail announcements were posted and sent by six professional sport and coaching organizations and high school athletic associations to their membership in a state in the northeastern United States. Participants were offered a chance to win cash gift cards in return for taking the survey.

In total, survey respondents included 308 sport coaches and 99 sport administrators (e.g., athletic directors). For the sport coaches, their median age was 44.0 years old (SD = 12.0), 65.3% were male, 91.0% classified themselves as Caucasian, 70.5% were married, and 77.0% had completed graduate-level education. In terms of their sport coaching experiences, 38.6% classified themselves as a full-time coach and 52.6% as a part-time coach; 51.1% primarily coached high school sports, 22.9% middle/junior high school sports, and 7.5% college/university sports. The responding coaches reported that on average during their lifetime, they had spent 21 years as an athlete, 11 years as a head coach, 5 years as an assistant coach, 6 years as a manager or administrator, 5 years as a volunteer, and 1 year as an intern. Finally, the sport coaches reported 895 separate coaching experiences in basketball (n = 193), soccer (n = 126), softball (n = 100), football (n = 76), baseball (n = 67), track and field (n = 62), volleyball (n = 62), lacrosse (n = 56), and the remaining 153 in sports such as bowling, golf, swimming and diving, tennis, weightlifting, and wrestling.

As for the sport administrators, their average age was slightly higher than the sport coaches' at 48.3 years old (*SD* = 12.0). Their demographics were similar to the sport coaches in that 69.8% were male, 90.4% classified themselves as Caucasian, 66.7% were married, and 86.8% had completed some type of graduate-level education. As for the level at which they were working, 67.6% indicated the senior high school level, 8.1% the college/university level, and 4.1% the middle/junior high school level. The responding administrators and managers reported that on average during their lifetime, they had spent 21 years as an athlete, 13 years as a head coach, 6 years as an assistant coach, 17 years as a manager or administrator, 3 years as a volunteer, and 1 year as an intern. Finally, in terms of the current primary role, 67.6% were an athletic director or director of athletics, with the remaining individuals spanning roles as a type of director, coordinator, manager, or another related administrative position.

Procedures

To survey both sport coaches and administrators, the researchers created two similar online surveys. Both surveys included 10 questions about respondents' playing and working experiences in sports, five questions about their sport education and training, 10 questions about their personal demographics, five questions about the characteristics and level of their organization(s) and team(s), and the items used to represent the eight domains and 40 standards included in the NSSC. For the 40 standards, respondents on both surveys were asked to evaluate the importance of each standard in terms of being an effective sport coach. A 0–10 Likert-type scale was used for all 40 standards, whereby 0 = *a sport coach does not need the standard listed to be an effective sport coach* and 10 = *a sport coach must have the standard listed to be an effective sport coach*. Because of the large number of items, to deter response bias, the researchers included a marker variable and randomly scattered it among the items. For the section on the eight domains, respondents were given the description of each domain listed in the NSSC (NASPE, 2006) and asked to

rank order (1 to 8) the domains in terms of importance to an effective coach, whereby 1 = *the most important sport coaching responsibility for effective coaches* and 8 = *the least important sport coaching responsibility for effective coaches*. Questions about the domains and standards were asked near the end of the survey, and the items measuring respondents' evaluations of the 40 standards were asked prior to items related to the eight domains, which helped to minimize response bias.

Results

The first set of items asked sport coaches and administrators to rate the importance of each of the 40 standards. Table 1 displays the average sport coaches' rating and ranking, average sport administrators' rating and ranking, and the average rating of responses from the coaches and administrators combined. The average ratings from sport coaches and administrators were also compared with independent samples *t* tests. The nonparametric Mann–Whitney U test was also conducted, comparing the normality and distribution of the responses from the sport coaches and sport administrators. Table 1 also shows the *t* value, degrees of freedom, and whether a significant difference is present, as determined from each statistical comparison of the means.

The second set of items referred to the eight domains. Table 2 displays the mean scores of the sport coaches' rankings and overall rank, the mean scores of the sport administrators' rankings and overall rank, and the average ranking of the combined sport coaches' and administrators' rankings. The average ratings from sport coaches and administrators were compared with independent samples *t* tests. Again, the nonparametric Mann–Whitney U test was also conducted, comparing the distribution and normality of both data sets; Table 2 also shows the *t* values, degrees of freedom, and whether a significant difference in the mean scores is present, as determined from each statistical comparison of the means.

Table 1

Ratings, Rankings, Averages, and Differences for the 40 Standards Between Sport Coaches and Sport Administrators

Domain	Standard	Coaches' mean rating	Rank for coaches' mean[a]	Admins' mean rating	Rank for admins' mean[a]	Overall mean of the ratings[b]	Rank for the overall mean	Sig. difference?[c] *t*(*df*)
Philosophy & Ethics	1. The ability to develop and implement an athlete-centered coaching philosophy.	8.78	#27	8.95	#23	8.82	#26	No *t*(225) = -.623
	2. The ability to identify, model, and teach positive values learned through sport participation.	9.47	#3	9.49	#5	9.47	#3	No *t*(225) = -.144
	3. The ability to teach and reinforce responsible personal, social, and ethical behavior of all people involved in the sport program.	9.48	#2	9.53	#3	9.49	#2	No *t*(225) = -.379
	4. The ability to demonstrate ethical conduct in all facets of the sport program.	9.63	#1	9.75	#1	9.66	#1	No *t*(225) = -1.059

Table 1 (cont.)

Domain	Standard	Coaches' mean rating	Rank for coaches' mean[a]	Admins' mean rating	Rank for admins' mean[a]	Overall mean of the ratings[b]	Rank for the overall mean	Sig. difference?[c] *t*(*df*)
Safety & Injury Prevention	5. The ability to prevent injuries by providing safe facilities.	9.22	#13	9.36	#9	9.25	#12	No *t*(225) = -.658
	6. The ability to ensure that all necessary protective equipment is available, properly fitted, and used appropriately.	9.31	#9	9.53	#4	9.36	#8	No *t*(225) = -1.216
	7. The ability to monitor environmental conditions and modify participation as needed to ensure the health and safety of everyone involved.	9.13	#17	9.16	#18	9.14	#18	No *t*(225) = -.145
	8. The ability to identify physical conditions that predispose athletes to injuries.	8.83	#25	8.85	#25	8.84	#25	No *t*(225) = -.093
	9. The ability to recognize injuries and provide immediate and appropriate care.	9.33	#8	9.31	#10	9.33	#9	No *t*(225) = .129
	10. The ability to facilitate a coordinated sports health care program that includes prevention, care, and management of injuries.	8.33	#36	8.36	#34	8.34	#36	No *t*(225) = -.116
	11. The ability to identify and address the psychological implications of injury.	8.41	#35	8.31	#35	8.39	#35	No *t*(225) = .393

Table 1 (cont.)

Domain	Standard	Coaches' mean rating	Rank for coaches' mean[a]	Admins' mean rating	Rank for admins' mean[a]	Overall mean of the ratings[b]	Rank for the overall mean	Sig. difference?[c] *t*(*df*)
Physical Conditioning	12. The ability to design programs of training, conditioning, and recovery that properly utilize exercise physiology and biomechanical principles.	8.63	#31	8.29	#36	8.55	#32	No *t*(225) = 1.231
	13. The ability to teach and encourage proper nutrition for optimal physical and mental performance and overall good health.	8.51	#33	8.38	#33	8.48	#33	No *t*(225) = .470
	14. The ability to be an advocate for drug-free sport participation and provide accurate information about drugs and supplements.	9.25	#11	9.24	#15	9.25	#13	No *t*(225) = .057
	15. The ability to plan conditioning programs to help athletes return to full participation following injury.	8.50	#34	8.42	#32	8.48	#34	No *t*(225) = .292
Growth & Development	16. The ability to apply knowledge of how developmental change influences the learning and performance of sport skills.	8.81	#26	8.78	#26	8.80	#27	No *t*(225) = .117
	17. The ability to facilitate the social and emotional growth of athletes by supporting a positive sport experience and lifelong participation in physical activity.	9.17	#15	9.27	#14	9.19	#16	No *t*(225) = -.538
	18. The ability to provide athletes with responsibility and leadership opportunities as they mature.	9.20	#14	9.24	#16	9.21	#14	No *t*(225) = -.172

Table 1 (cont.)

Domain	Standard	Coaches' mean rating	Rank for coaches' mean[a]	Admins' mean rating	Rank for admins' mean[a]	Overall mean of the ratings[b]	Rank for the overall mean	Sig. difference?[c] *t*(*df*)
Teaching & Communication	19. The ability to provide a positive learning environment that is appropriate to the characteristics of the athletes and goals of the program.	9.38	#7	9.56	#2	9.43	#6	No *t*(225) = -1.138
	20. The ability to develop and monitor goals and objectives for the athletes and program.	9.01	#20	8.91	#24	8.98	#20	No *t*(225) = .498
	21. The ability to organize practice based on a seasonal or annual practice plan to maintain motivation, manage fatigue, and allow for peak performance at the appropriate time.	9.24	#12	9.31	#11	9.26	#10	No *t*(225) = -.360
	22. The ability to plan and implement daily practice activities that maximize time on task and available resources.	9.43	#5	9.42	#7	9.43	#5	No *t*(225) = .082
	23. The ability to utilize appropriate instructional strategies to facilitate athlete development and performance.	9.28	#10	9.18	#17	9.26	#11	No *t*(225) = .668
	24. The ability to teach and incorporate mental skills to enhance performance and reduce sport anxiety.	8.78	#28	8.51	#29	8.72	#28	No *t*(225) = 1.138
	25. The ability to use effective communication skills to enhance individual learning, group success, and enjoyment in the sport experience.	9.45	#4	9.40	#8	9.44	#4	No *t*(225) = .322
	26. The ability to demonstrate and utilize appropriate and effective motivational techniques to enhance athlete performance and satisfaction.	9.12	#18	9.29	#13	9.16	#17	No *t*(225) = -.947

Table 1 (cont.)

Domain	Standard	Coaches' mean rating	Rank for coaches' mean[a]	Admins' mean rating	Rank for admins' mean[a]	Overall mean of the ratings[b]	Rank for the overall mean	Sig. difference?[c] *t*(*df*)
Skills & Tactics	27. The ability to know the skills, elements of skill combinations, and techniques associated with the sport being coached.	9.42	#6	9.29	#12	9.39	#7	No $t(225) = .839$
	28. The ability to identify, develop, and apply competitive sport strategies and specific tactics appropriate for the age and skill levels of the participating athletes.	9.14	#16	8.98	#21	9.10	#19	No $t(225) = .885$
	29. The ability to use scouting methods for planning practices, game preparation, and game analysis.	8.08	#37	8.11	#37	8.08	#37	No $t(225) = -.096$
Organization & Administration	30. The ability to demonstrate efficiency in contest management.	8.68	#29	8.49	#30	8.63	#29	No $t(225) = .809$
	31. The ability to be involved in public relation activities for the sport program.	7.99	#39	7.71	#39	7.93	#39	No $t(225) = .913$
	32. The ability to manage human resources for the program.	8.08	#38	8.00	#38	8.06	#38	No $t(225) = .258$
	33. The ability to manage fiscal resources for the program.	7.51	#40	7.62	#40	7.54	#40	No $t(225) = -.282$
	34. The ability to facilitate planning, implementation, and documentation of the emergency action plan.	8.85	#24	8.96	#22	8.88	#24	No $t(225) = -.446$
	35. The ability to manage all information, documents, and records for the program.	8.64	#30	8.49	#31	8.60	#30	No $t(225) = .547$
	36. The ability to fulfill all legal responsibilities and risk management procedures associated with coaching.	9.12	#19	9.49	#6	9.21	#15	No $t(225) = -1.731$

Table 1 (cont.)

Domain	Standard	Coaches' mean rating	Rank for coaches' mean[a]	Admins' mean rating	Rank for admins' mean[a]	Overall mean of the ratings[b]	Rank for the overall mean	Sig. difference?[c] *t*(*df*)
Evaluation	37. The ability to implement effective evaluation techniques for team performance in relation to established goals.	8.92	#21	8.76	#27	8.88	#23	No *t*(225) = .730
	38. The ability to use a variety of strategies to evaluate athlete motivation and individual performance as they relate to season objectives and goals.	8.91	#22	9.09	#19	8.96	#21	No *t*(225) = -.820
	39. The ability to utilize an effective and objective process for evaluation of athletes in order to assign roles or positions and establish individual goals.	8.88	#23	9.02	#20	8.91	#22	No *t*(225) = -.619
	40. The ability to utilize an objective and effective process for evaluation of self and staff.	8.62	#32	8.55	#28	8.60	#31	No *t*(225) = .261

Note. Sig. difference = Significant difference between the rating given by sport coaches and sport administrators.

[a]The lower the number, the higher the standard was rated (e.g., 1 = the most important standard, 40 = the least important standard). [b]The average ratings are weighted based on the sample sizes of both respective groups (coaches: n = 172, administrators: n = 55). [c]The nonparametric Mann–Whitney U test also used to examine the distribution of both data sets.

Table 2

Rankings, Averages, and Differences for the Eight Domains Between Sport Coaches and Sport Administrators

Domain	Coaches' mean ranking	Rank for coaches' mean[a]	Admins' mean ranking	Rank for admins' mean[a]	Overall mean of the rankings[b]	Rank for the overall mean	Sig. difference?[c] *t*(*df*)
Philosophy & Ethics	4.10	#3	3.85	#3	4.04	#3	No $t(225) = .689$
Safety & Injury Prevention	3.67	#2	3.25	#1	3.57	#2	No $t(225) = 1.172$
Physical Conditioning	4.69	#6	4.78	#6	4.71	#6	No $t(225) = -.312$
Growth & Development	4.31	#4	4.73	#5	4.41	#4	No $t(225) = -1.350$
Teaching & Communication	3.32	#1	3.40	#2	3.34	#1	No $t(225) = -.239$
Skills & Tactics	4.35	#5	4.62	#4	4.41	#5	No $t(225) = -.871$
Organization & Administration	5.84	#8	5.95	#8	5.87	#8	No $t(225) = -.296$
Evaluation	5.72	#7	5.42	#7	5.65	#7	No $t(225) = .937$

Note. Sig. difference = Significant difference between the rating given by sport coaches and sport administrators.

[a]The lower the number, the higher the standard was rated (e.g., 1 = the most important domain, 40 = the least important domain). [b]The average ratings are weighted based on the sample sizes of both respective groups (coaches: $n = 172$, administrators: $n = 55$). [c]The nonparametric Mann–Whitney U test also used to examine the distribution of both data sets.

Discussion

There are at least six important results of this research that merit discussion. First, based on the overall mean ratings and rankings, Domain 1 (Philosophy and Ethics) has the top three highest ranked standards by sport coaches and administrators; however, Standard 1 ("The ability to develop and implement an athlete-centered coaching philosophy") is not as highly rated and ranked as Standards 2, 3, and 4. This result reinforces the importance of examining coaching education areas based on standards (competencies) and domains (topical areas), because the results may differ. In addition, differences in the ratings and rankings of the standards within each domain can be seen clearly in other domains. For example, in Domain 3 (Physical Conditioning), although Standards 12, 13, and 15 are rated and ranked relatively low by sport coaches and administrators, Standard 14 ("The ability to be an advocate for drug-free sport participation and provide accurate information about drugs and supplements") is ranked higher. Recently, due to increasing focus of local, state, national, and international sport organizations and governing bodies on athletes and their use of performance-enhancing drugs and supplements, it is not surprising that this standard stands out as more highly ranked by sport coaches and administrators. Finally, although no statistically significant differences between any standards were found between sport coaches and administrators, scholars could investigate why certain standards are ranked more highly than others.

Second, for the mean scores for sport coaches and administrators regarding the 40 standards, all mean ratings are greater than 7.50 (on a 0–10 scale) for both sample populations. These results suggest that, in the opinion of sport coaches and administrators, all 40 standards represent important knowledge and abilities that effective sport coaches need to have. As the NSSC has evolved over the years into the current version, the authors and contributors have clearly been successful at identifying important knowledge and skills sport coaches need to have. Thus, the future areas for expanding and improving the next version of the NSSC are not currently listed, so research to identify any current gaps in the existing standards.

Table 1 displays the next set of interesting results. After looking at all of the results in this table, the researchers found no statistically

significant differences between the perceptions of sport coaches and administrators. The statistically insignificant differences suggest that sport coaches and administrators in the sample populations have similar perceptions about the importance all 40 standards relative to being an effective sport coach. Because the majority of both sample populations come from the junior high and high school levels, future research should examine if sport coaches and administrators at other levels show the same type of similarities.

Next, the results displayed in Table 2 are examined. The rankings indicate which domain is most highly prioritized by sport coaches and administrators. The two highest ranked domains by sport coaches and administrators are Domain 5 (Teaching and Communication) and Domain 2 (Safety and Injury Prevention). The two domains that are ranked lowest are Domain 8 (Evaluation) and Domain 7 (Organization and Administration). To a large extent, these results likely reflect the most important and/or frequent tasks that sport coaches feel they do and administrators perceive coaches (should) do. Future research could further examine why sport coaches and administrators ranked each domain as they did.

Similar to the results in Table 1, the results in Table 2 are consistent between the two respondent groups. Sport coaches and administrators ranked Domains 1, 3, 7, and 8 the same, whereas the results for Domains 2 and 5 and Domains 4 and 6 are simply switched. Further, the researchers found no significant differences between sport coaches' or administrators' rankings for any of the eight domains. Additional research could refine and expand the domains and the descriptions and content of each domain.

When specifically examining which standards from which domains in Table 1 were most highly rated compared to the rankings displayed in Table 2, the researchers found interesting contrasts. In Table 1, Domain 1 had three of four standards ranked as the top three standards; however, in Table 2, Domain 1 was ranked as the third most important domain behind Domain 5 and Domain 2, respectively. Along similar lines, in Table 1, Standards 8, 10, and 11 in Domain 2 are rated low, whereas in Table 2, the overall ranking was the second highest. As discussed, there may be refinements and improvements to the descriptions and contents of the domains that may more fully explain and encompass all of the relevant and important content sport coaches need to have to be effective.

Finally, as detailed in the next section, one additional area of future research is of great importance. The authors of the NSSC discuss and briefly describe how the standards could be applied to coaches at various levels of competency and experience (e.g., novice to expert coaches). Future research and revisions to the NSSC should continue to examine and expand on this area. For example, Delphi studies of sport coaching experts could be conducted about the domains and standards that sport coaches need to focus on early in their career (and continuing coaching education programs later in their career) could be better identified and implemented.

Conclusion and Limitations

Several important conclusions can be drawn from the results of this research. First, it is encouraging to see that sport coaches and administrators highly rated all 40 standards in the NSSC. When sport coaching educators at local, state, national, or international organizations need a list of topics and abilities that sport coaches should know and understand, the NSSC would be a good starting point, as the evidence in this research suggests. After examining the results for sport coaches and administrators side by side, the researchers found it reassuring that the results from both groups are similar. In many sport organizations, sport coaches and administrators have an adversarial relationship (Massengale & Sage, 1995). One area in which sport coaches and administrators need to see eye to eye is the necessary coaching knowledge needed to be effective. Even if their perspectives do not completely overlap, it is still important that sport coaches and administrators understand each other and their respective roles, responsibilities, and abilities. Additional research that validates and corroborates what sport coaches and administrators believe about effective coaching is also needed. This research can include opinions and feedback from student athletes and parents at all levels. This leads to another potential interesting area of inquiry that would allow for enhanced understanding between coaches and administrators: sport coaches' opinions about the important abilities and experiences of effective sport administrators.

In terms of the limitations of this research, the respondents (and their demographics) are a large issue that may have affected the findings of this research. For research with national implications, sampling is an important issue that many researchers face. To

collect the data for this research, the authors worked closely with numerous state-level sport organizations. Within most U.S. states, sport organizations are usually centered on the public and private education and athletic systems (e.g., elementary, junior, and senior high schools). Therefore, despite the researchers' attempts to recruit the most broad sample possible, respondents still may not reflect the true diversity of a more national or international sample of sport coaches and administrators.

Another important limitation is that one of the newest areas of sport coaching education revolves around the notion that sport coaches are all at different stages and levels in their coaching career. Some sport coaches may be full-time coaches for more than 30 years and be considered an expert coach, whereas other sport coaches may be volunteers who have only been coaching on an as-needed basis. The most recent version of the NSSC contains basic information about how sport coaches may be at different stages in their career (e.g., novice, expert); however, the NSSC includes little information that suggests which domains and standards novice coaches should undertake and which areas expert coaches should pay attention to so that they have the most current and up-to-date knowledge. In this research, the results from coaches and administrators with different roles and at different stages in their career are combined together, instead of, for example, segmenting them based on their job title or level of expertise. It is expected that expert coaches are more likely to be proficient in areas such as Philosophy and Ethics, whereas in areas such as Safety and Injury Prevention new discoveries are constantly being made, so modern and up-to-date information must be continually learned and studied.

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FITNESS

Acute Exercise and Academic Achievement in High School Youth

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Abstract

The purpose of this study was to compare the acute effects of Aerobic Exercise (AE), Resistance Exercise (RE), and a nonexercise (NE) control on measures of academic achievement (AA) and cognition in 10th grade males and females. This study utilized a randomized crossover design. Tenth grade males and females performed three exercise trials (AE, RE, NE) separated by 7 days each. Immediately following exercise, participants completed a 10-question mathematics test, followed by the Stroop test. A repeated measures ANOVA revealed small but insignificant differences in mean math test performance between RE and NE, $F(1,86) = 2.81$, $p = .098$, $\eta^2 = .032$, and AE and NE, $F(1,86) = 2.03$, $p = .158$, $\eta^2 = .023$. Significant differences were found between RE and NE in the Stroop dot test, $F(1,86) = 4.31$, $p = .041$, $\eta^2 = .048$, and between AE and NE in the Stroop dot test, $F(1,86) = 10.402$, $p = .002$, $\eta^2 = .108$, and Stroop color test, $F(1,86) = 6.85$, $p = .01$, $\eta^2 = .074$. In conclusion, acute RE and AE did not significantly improve scores on a test of mathematics, but did improve measures of cognition in comparison to an NE control.

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Current research trends in the area of youth physical activity (PA) have highlighted the relationship between students who meet or exceed activity guidelines with improved academic results (Carlson et al., 2008). Numerous studies have established that when maintaining greater levels of PA, students experience improved performance in academic areas over their peers who fail to meet the recommended PA guidelines (Howie & Pate, 2012). Given the high levels of importance currently being placed on academic test results and the rising rates of overweight and obesity among students, it behooves educators, students, and PA proponents to explore the mechanisms that underscore exercise and academic achievement (AA).

The literature linking exercise and AA shows significant relationships between chronic and acute exercise and student improvement in school. Studies of chronic exercise show consistently small, positive associations between exercise and AA (Nelson & Gordon-Larsen, 2006). Acute exercise has demonstrated similarly small, significant effects on measures of cognition and other executive functions across children, adolescents, and adults (Verburgh, Königs, Scherder, & Oosterlaan, 2014). Such findings lend credence to the ability of exercise to influence AA, but a number of questions related to the effect of acute exercise on AA in youth still exist. One important question that deserves exploration is whether a difference in AA exists following bouts of differing types of exercise, specifically resistance and aerobic exercise (AE). AE has been used almost exclusively among youth studies that utilized a measure of executive function or AA as the dependent variable. Among high school–aged students specifically, researchers have targeted AA with AE interventions such as sport and PE participation (Nelson & Gordon-Larsen, 2006), extracurricular PA (Crosnoe, 2002), and traditional AE such as walking or jogging (Wittberg, Northrup, & Cottrell, 2012). Each of the above variations of AE demonstrated positive outcomes on select measures of AA including mathematics, reading ability, and GPA.

Although AE has shown consistently positive effects on AA in high school–aged students, there is a paucity of research examining the effects of resistance exercise (RE) on AA in this age group. Research on senior citizens (Chang & Etnier, 2009), adults (Alves

et al., 2012), and high school youth (Harveson et al., 2015) indicates that acute RE may influence cognition positively. Additionally, RE is a mode of exercise that effectively complements AE (Pollock et al., 2000). With the above research in mind, indications are such that acute RE may be an effective intervention to influence AA positively in high school–aged students. As such, the purpose of this study was to compare the acute effects of AE, RE, and a nonexercise (NE) control on measures of AA and cognition in 10th grade males and females. It was hypothesized that AE and RE would improve students' performance on a standardized test of mathematics and a test of cognition, in comparison to the NE control.

Method

Participants and Setting

The participants in this study were 10th grade students sampled from a high school in the southwestern United States. An a priori power analysis (G*power) indicated a minimal sample size of 60 participants. After subject dropout, the total number of participants was 91 (63 males, 28 females), with a mean age of 15.89 ± 0.65 years. Participants provided written assent in conjunction with written consent from a parent or legal guardian. Participants were apparently healthy, as defined by their enrollment in PE class, and able to participate in regular exercise. The study was conducted in accordance with institutional, district, and American College of Sports Medicine (ACSM) ethical guidelines. The university institutional review board provided approval for study procedures.

Instruments

AA was measured in this study using a battery of four 10-question math tests taken from New York State Testing Program exams used for high schoolers in the last 5 years (http://www.p12.nysed.gov/assessment/). The tests are therefore current, and they come with technical manuals that verify the multiple choice content with Cronbach's alpha coefficient scores. The tests have internal consistency coefficients of $r = .85$ (2012), $r = .84$ (2011), and $r = .86$ (2010). The New York State Testing Program assembled the tests with assistance from high school math teachers to ensure the content had been covered in the current school year. The content of each test

covered similar material, but the questions were slightly different, and thus a practice effect was avoided. Students were given 5 min to complete each 10-question test. This mimicked the demands of a classroom setting and allowed the use of the speed-test concept developed by Brown (1970). Cognition was measured using the Stroop test (Victoria version). The Victoria version of the Stroop test is a validated means of assessing selective attention and cognitive flexibility over the course of three increasingly demanding tasks (Spreen, 1998) and has been utilized frequently in research with children, high school youth, and adults (Bub, Masson, & Lalonde, 2006; Comalli, Wapner, & Werner, 1962). Participants identified stimulus flash cards beginning with colored dots, progressing to common words printed in the same color as dots, and ending with color words printed in noncorresponding colors. Each task contained 24 items and challenged participants to deal with an interference effect, which is marked by significantly slower reaction time.

Procedures

This study utilized a randomized crossover design. Participants were required to perform one familiarization session on the mathematics test and exercise protocols. Seven days after the familiarization session, participants performed one of three experimental sessions (AE, RE, NE) in a randomized order, completing all three interventions over 3 weeks. The math test was initiated 5 min after the exercise intervention. Upon completion of the math test, the Stroop tests were administered in sequence (dot, color, word), no later than 20 min after completion of each exercise intervention, in accordance with prior research (Hillman, Pontifex, Raine, Castelli, & Kramer, 2009). The author and trained research assistants performed data collection.

The AE and RE protocols were based on previous work by Alves et al. (2012). The RE protocol involved two sets of 15 repetitions in the following exercises: leg press, bench press, lat pull down, cable row, back extension, and biceps curl. If participants were not able to complete 15 repetitions/set, a 5% reduction in weight was allowed (Pontifex, Hillman, Fernhall, Thompson, & Valentini, 2009). A 1-min rest interval was assigned between sets. The RE intervention was 30 min in length. The AE protocol was matched for time and consisted of 30 min of walking/jogging at an intensity of 50% to 60%

age-predicted heart rate max. In the NE control, participants sat quietly for 30 min while viewing a sports-related DVD. Participants were monitored to ensure they did not fall asleep or move around (Pontifex et al., 2009). Participants were also monitored via heart rate telemetry during both exercise interventions using Polar E600 heart rate monitors, which are designed and recommended for classroom PE use. Participants were also assessed with Borg's original rating of perceived exertion scale, which was used to monitor exercise intensity more closely across experimental interventions (Borg, 1970).

Data Analysis

A repeated measures analysis of variance (ANOVA) was used to determine whether differences existed among the treatments (AE, RE, NE). Statistical significance was determined with an alpha of .05. All analyses were completed using SPSS 22.0.

Results

Table 1 displays mean values for all variables across exercise interventions. A repeated measures ANOVA revealed no significant difference in mean math test performance between RE and NE, $F(1, 86) = 2.81$, $p = .098$, $\eta^2 = .032$; AE and NE, $F(1, 86) = 2.03$, $p = .158$, $\eta^2 = .023$; and AE and RE, $F(1, 86) = 0.04$, $p = .837$, $\eta^2 < .001$. No differences were found between male and female participants in mean math test performance following any exercise intervention. Figure 1 illustrates the results.

Table 1
Mean (SD) Values for Stroop Test Performance, Math Test Performance, Heart Rate, Rating of Perceived Exertion

Exercise type	Stroop dot *M* (*SD*)	Stroop word *M* (*SD*)	Stroop color *M* (*SD*)	Math scores *M* (*SD*)	Heart rate *M* (*SD*)	RPE *M* (*SD*)
Aerobic	9.810 (1.78)	11.205 (2.58)	15.885 (4.23)	3.3862 (2.01)	125.86 (18.04)	2.72 (0.75)
Resistance	10.08 (1.83)	11.40 (2.33)	16.368 (4.69)	3.389 (2.2)	119.58 (12.62)	3.4 (0.78)
Nonexercise	10.44 (2.05)	11.55 (2.26)	16.93 (4.31)	2.954 (2.1)		

Note. RPE = rating of perceived exertion.

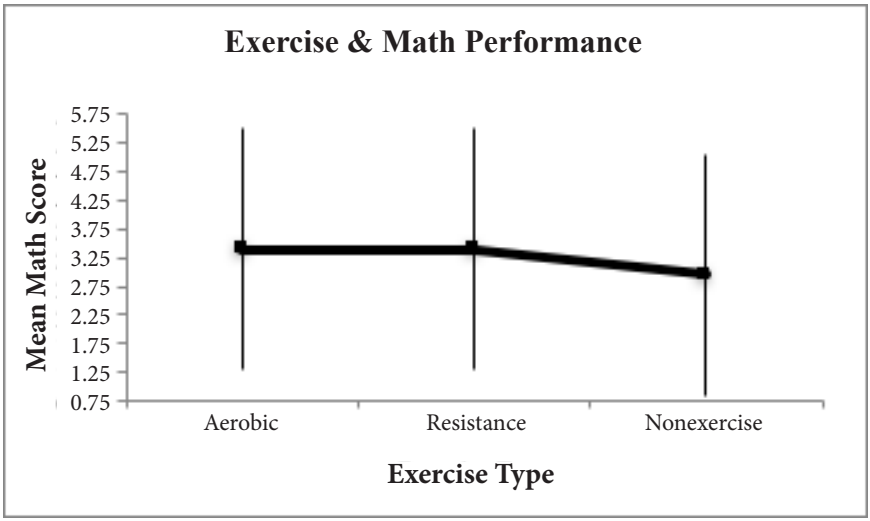

Figure 1. Mean math scores following various exercise types.

Results of separate repeated measures ANOVAs revealed significant differences between RE and NE in the Stroop dot test, $F(1, 86) = 4.31$, $p = .041$, $\eta^2 = .048$, and approached statistical significance in the Stroop word test, $F(1, 86) = 3.66$, $p = .059$, $\eta^2 = .041$. Significant differences were also found between AE and NE in the Stroop dot test, $F(1, 86) = 10.402$, $p = .002$, $\eta^2 = .108$, and Stroop color test, $F(1, 86) = 6.85$, $p = .01$, $\eta^2 = .074$. Differences between AE and NE approached statistical significance in the Stroop word test, $F(1, 86) = 3.63$, $p = .06$, $\eta^2 = .040$. No differences were found between male and female participants in Stroop test performance following any exercise intervention. Figure 2 illustrates the results.

Discussion

Contrary to the primary hypothesis, acute AE and RE did not demonstrate statistically significant improvements in mean math test performance in comparison to NE. Practical significance as measured by effect size greater than $\eta^2 = .04$ (Ferguson, 2009) was not achieved statistically, but both exercise interventions resulted in greater mean performance than the NE control by nearly 5%. As such, the author believes an argument could be made for the findings being practically significant for day-to-day classroom achievement. Such findings are in agreement with prior literature, which has consistently indicated that acute exercise exhibits small, positive changes in AA and cog-

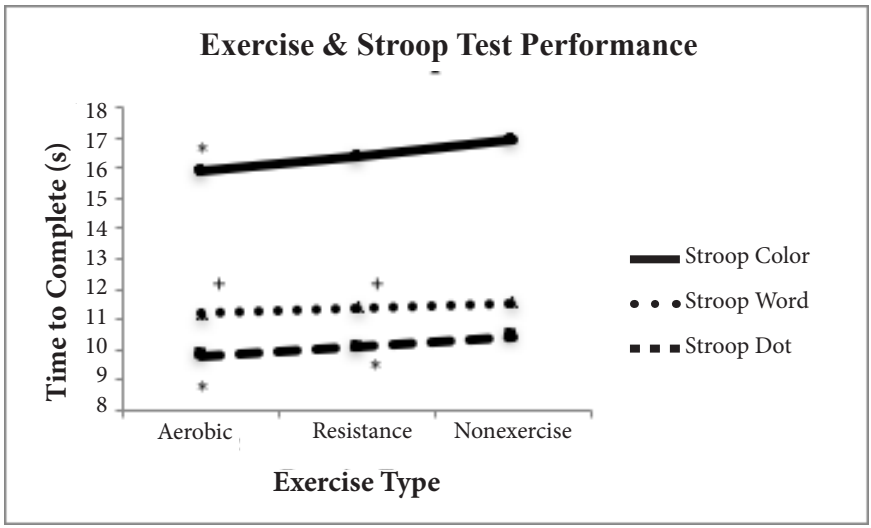

Figure 2. Time to complete Stroop dot, word, and color tests following various exercise types. $^{*}p < .05$. $^{+}\eta^2 > .04$.

nition (Chang, Labban, Gapin, & Etnier, 2012; Hillman, Kamijo, & Scudder, 2011; Travlos et al., 2010). Considering the test-centered approach that exists in today's educational environment, such findings should be of interest to parents, educators, administrators, and legislators. In partial agreement with the secondary hypothesis, RE significantly improved performance in the Stroop dot test compared to NE and approached statistically significant improvement in the Stroop word test compared to NE. Significant differences were also found between AE and NE in the Stroop dot and color tests, and the results approached statistical significance in the Stroop word test. Although findings related to AE agree with results in prior literature, this study marks the first instance of researchers utilizing acute RE to effect improvement in AA in a high school–aged sample. Although AA and cognitive performance increases were modest following both exercise interventions, the author hopes that such results will further strengthen the argument supporting increased PA, be it RE or AE, in the typical school day among high school–aged students.

Although the literature has demonstrated consistently small, positive changes in AA and cognition following acute exercise, the mechanisms underlying such changes are still being explored. Given that AE and RE resulted in modest increases in AA and cognition

in this study, it appears that exercise type may not play a selective role in boosting higher-order brain processes. Rather, a wide variety of PA types can likely produce increases in executive functions. Hillman, Buck, Themanson, Pontifex, and Castelli (2009) may have inadvertently established support for such an idea by introducing the neurotrophic-stimulation hypothesis. This hypothesis states that neuromuscular activity stimulates areas of the brain that control executive function, resource allocation, and speed of processing. The hypothesis was developed based on studies of AE, but it has logical application to RE as well, given the nature of RE and its development of the neuromuscular system (Häkkinen et al., 2003). Similarly, acute RE and AE have been shown to elevate brain-derived neurotrophic factor (Seifert et al., 2010; Yarrow, White, McCoy, & Borst, 2010). Brain-derived neurotrophic factor has been shown to protect against neurodegeneration, enhance neural plasticity, and improve learning and memory (Yarrow et al., 2010), which make it a prime candidate for label as a causative agent behind the increase in AA and cognition following acute exercise. Finally, one of the more documented hypotheses related to acute exercise and its ability to enhance executive functions is the cerebral blood-flow hypothesis. This hypothesis states that during moderate exercise up to 60% VO_2 max, blood flow to the brain increases, delivering additional oxygen and nutrients that appear to optimize the physiologic state of the brain and benefit cognition and AA (Guiney, Lucas, Cotter, & Machado, 2015). Given the greater oxygen uptake levels associated with AE as compared to RE, this hypothesis has frequently been cited in the literature as a primary mechanism underlying the small, positive changes in cognition and AA in research. It is also possible that increased cerebral blood flow worked synergistically with mechanisms such as brain-derived neurotrophic factor to produce the increased performance in AA and cognition in this study. Additional research should be directed at isolating the precise mechanisms that drive the changes in executive function throughout the literature.

The results of this study bolster the current literature, but one limitation must be addressed. Specifically, student motivation appeared to be an issue, especially during mathematics testing. Motivation was not directly measured in this study, but it was apparent to the author that many of the students were not overly concerned with

doing their best on the math tests, because they knew there were no academic repercussions for poor performance. Castelli, Hillman, Buck, and Erwin (2007) also discussed motivation, noting that students who typically enjoy academics may perform better on tests of AA than their peers who are less academically inclined. Thus, the construct of motivation could explain some of the variance credited to the individual exercise protocols utilized in this study. Future research would be wise to measure or control for student motivation to eliminate as much variance as possible.

In conclusion, the results of this study demonstrate that acute AE and RE can lead to small, positive changes in AA and cognition in a high school youth sample. These results are novel in that they mark the first example of researchers using acute RE to enhance AA among a high school–aged sample. Additionally, the findings expand youth school-based PA recommendations to include RE as a means to influence AA and cognition. These findings may be valuable for PE teachers, educators, and administrators who are involved in daily programming to maximize student effectiveness in the classroom. Given that equipment and available space are often primary considerations in school PA settings, the option of utilizing RE or AE could be valuable for physical educators seeking to influence their students' academic success while improving students' health.

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FITNESS

Comparison of Strength Gains in Untrained College-Age Females Using Free Weights and FreeMotion Machines

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Abstract

Resistance training has become a preferred method for developing muscular strength among various populations. A variety of resistance training modes are available, but there are mixed outcomes regarding strength development among barbells, dumbbells, and weight machines. The purpose of this study was to investigate the differences in strength improvements between dumbbell and FreeMotion machine training. Twenty college-age females were randomly assigned into dumbbell or FreeMotion groups, but only 8 in the dumbbell group completed. Both groups followed a nearly identical progressive strength training program on each of their training modes for 8 weeks. Participants were tested on their one-repetition max (1-RM) on a barbell bench press and barbell back squat before and after the intervention program. A repeated measures ANOVA analysis compared 1-RM changes between groups, and effect sizes were calculated. Significant increases in strength improvements ($p < .001$) were observed for the dumbbell

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and FreeMotion groups, with moderate effect size for the 1-RM barbell bench press (d = 0.56) and a moderate to large effect size for the 1-RM barbell back squat (d = 0.73). There was no Group × Time interaction for the strength tests (p = .201 for 1-RM barbell bench press and p = .816 for the 1-RM barbell back squat, respectively). Dumbbells and FreeMotion machines were equally effective in improving strength in college-age females. The findings add to the literature on FreeMotion machines and benefit novice resistance trainers, physical educators, and fitness professionals. The study should be replicated with additional populations.

Resistance training is an effective method for various populations to develop muscular strength. Although free weights are considered the preferred mode of strength training, the development of various weight machines has extended the possible application of resistance training (Crone, 2011). In free weight exercise, the load being lifted remains constant throughout the range of motion. However, according to Crone (2011), the configuration of the joint causes the application of force to change at different points in that range of motion. A variety of weight machines have been designed in an attempt to match the resistance to potential force capability at different points in the range of motion to maximize the development of strength (McMaster, Cronin, & McGuigan, 2009).

Free weights are entirely controlled by the lifter and require the lifter to use synergistic muscles to control the weight throughout the range of motion (McCaw & Friday, 1994). To the contrary, weight machines guide the resistance through a specific path, reducing the activation by synergistic muscles (McCaw & Friday, 1994; Schick et al., 2010). A distinct manufacturer of resistance training machine called FreeMotion (FreeMotion Fitness, 2016) eliminates this fixed-path resistance. However, there is limited research on FreeMotion machines (Spennewyn, 2008). Similar to free weights, FreeMotion machines are controlled exclusively by the lifter and are capable of following an unrestricted range of motion. Dumbbell weights, in particular, are highly comparable to FreeMotion machines because, unlike the barbell or a traditional variable resistance training machine, these modes of training allow the lifter to hold the weight in each hand and perform exercises in a unilateral and unrestricted range of motion.

Because of the similarities in load application between dumbells and FreeMotion machines during the lifting range of motion, there is potential for comparable strength improvements throughout an individual's training. However, it is unclear if one mode of training is superior to the other regarding gains in strength (Langford, McCurdy, Ernest, Doscher, & Walters, 2007; Simpson, Rozenek, Garhammer, Lacourse, & Storer, 1997). With the increasing popularity of resistance training exercise, it would be advantageous to compare muscular strength gains among different strength training modes. Therefore, the purpose of this investigation was to examine the effects of different resistance training programs on the strength of untrained college-age females using dumbbell free weights and FreeMotion machines. It was hypothesized there would be no differences in strength gains between females in the two training methods.

Method

Participants

Participants were untrained females (no resistance training within past year) between the ages of 18 and 28 years who volunteered to participate in the study. To participate, the women had to be free from any chronic diseases such as coronary heart disease, diabetes, lung disease, or orthopedic problems that could prevent their participation. Pregnant women could not participate in the study. Additionally, the women had to have a BMI of less than 30 kg/m^2 to be eligible to participate. Participants consisted of female undergraduate and graduate students recruited from a university in the southeastern United States. The study was approved by the university institutional review board. All participants completed and signed an informed consent agreement form after having the risks and benefits of the study explained to them. Participants also completed and signed a Physical Activity Readiness Questionnaire (PAR-Q; Canadian Society for Exercise Physiology, 2002) and an American College of Sports Medicine (ACSM, 2014) health history form prior to participating in the study.

Procedures

The research was conducted in the summer and fall of 2015. There were two waves of recruitment. The summer participants were

recruited through a flyer that was e-mailed to all university students and faculty and staff members. The flyer was also posted in several areas on the university's campus. The information printed on the flyer informed the future participants of inclusion criteria for participation in the study. In the fall, participants were recruited from the university's weight training classes. These students must have also met the inclusionary criteria to participate.

The researchers then randomized participants into either a dumbbell group or a FreeMotion training group by selecting their ID numbers out of a hat. The participants self-selected two nonconsecutive days throughout each of the 8 weeks on which to train. In addition, the participants were free to choose what time they trained on each of the days. After selecting their days and times, they were asked to stay consistent with those days and times each week. The participants were also required to agree to refrain from engaging in any other weight training exercises during the 8 weeks of the study.

Prior to the start of the study, the participants' height, weight, BMI, and waist circumference were measured. They were also assessed on their one-repetition maximum (1-RM) barbell bench press and 1-RM barbell back squat prior to beginning the 8-week progressive strength training program. The ACSM 1-RM protocol was used to obtain maximal strength (ACSM, 2014). Throughout the 8-week strength training period, the dumbbell group followed a progressive strength training program using only dumbbells. The FreeMotion group followed a nearly identical program using only FreeMotion machine weights. Each participant had her own file, which contained her workout program. The participants were given an identification number, which was printed on the outside of their files. The participants were instructed to record their weights for each set of the exercises performed.

To track participant attendance, the researcher provided a sign-in sheet located at the front desk of the facility. The participant was instructed to sign in and record the time she began training each day of each week. She was also instructed to sign out when she had completed her training session for that day. A new sign-sheet sheet was provided at the end of each week. The researcher collected the sign-in sheets at the end of every week throughout the study. The researcher stayed in contact with each participant via e-mail or text

messaging to provide encouragement and to make sure the participants were performing their workouts.

For the first week of the study, a researcher was present for all of the participants' workout sessions to ensure that they were performing each exercise correctly and to answer any questions regarding the workout program. After the first week, the participants performed the workouts on their own, without supervision. However, the lead researcher performed random spot checks to ensure that the participants were performing their workouts correctly. The dumbbell and FreeMotion groups trained twice per week. The workout session for Day 1 (Workout A) of each week consisted of total body exercises (squats, chest press, lunges, shoulder press, chest fly, reverse fly, bicep curls, and triceps extensions). The workout session for Day 2 (Workout B) included the same exercises in a different order. The rest time in between each exercise and the tempo of each exercise was identical for the dumbbell and FreeMotion groups. The only difference between the training programs for the two groups was that the dumbbell group trained only using dumbbells and the FreeMotion group trained using only the FreeMotion machines. Table 1 shows examples of the first week's Workout A programs for both groups. The workouts progressed in intensity every 2 weeks with lower repetitions and longer rest breaks over the 8-week study. In the final weeks, participants performed 4 sets of 5–6 repetitions with 2.5 min rest between sets. Immediately following the 8-week period, both groups were reassessed on their 1-RM barbell bench press and 1-RM barbell back squat. The participants' weight, BMI, and waist circumference were also measured.

Data Analyses

The changes in strength gains observed among females in the resistance training modes were analyzed and interpreted using SPSS version 22 (IBM Corporation, Armonk, NY). The alpha level was set at $p < .05$. Descriptive statistics were calculated on the participants' age, height, weight, BMI, and waist circumference. A repeated measures ANOVA determined the differences in strength between the dumbbell and FreeMotion groups. The mean and standard deviations for the 1-RM for both groups were inserted into Cohen's *d* calculator, which determined the effect size of strength improvements (Soper, 2016).

Table 1
Week 1 Resistance Training Workout A for Dumbbell and FreeMotion Training

Dumbbell exercise	FreeMotion exercise	Sets	Repetitions	Tempo s	Rest s
DB squat	Two leg squat	2	8–10	4–2	60
DB incline chest press	Two arm incline chest press	2	8–10	4–2	60
DB lunges	Lunges	2	8–10	4–2	60
DB seated shoulder press	Two arm seated shoulder press	2	8–10	4–2	60
DB chest fly	Two arm chest fly	2	8–10	4–2	60
DB reverse fly	Two arm reverse fly	2	8–10		
DB alternating bicep curl	Alternating arms bicep curl	2	8–10	4–2	60
DB standing overhead triceps extension	Standing overhead triceps extension	2	8–10	4–2	60

Note. DB = dumbbell. Tempo is number of seconds in concentric and eccentric phase of lift.

Results

This study consisted of 18 untrained women between the ages of 18 and 28 years who completed the study. Participants were randomly assigned to a dumbbell or FreeMotion resistance training group. Both groups began the study with 10 participants; however, two participants from the dumbbell group dropped out of the study. One participant failed to complete the study because of the development of a health condition that was unrelated to the study, and the other participant moved away. Both groups followed a nearly identical progressive strength training program for 8 weeks. The groups were assessed pre- and posttest on 1-RM barbell bench press and 1-RM barbell back squat. The 18 participants who remained completed 97% of the study workouts.

Participant Characteristics

Table 2 presents participants' descriptive statistics for age, BMI, and waist circumference. The mean age of all participants was 20.5 (SD = 3.0) years. Following the 8-week study, there were no significant changes over time in their BMI, $F(1, 16) = .351$, $p = .922$, or waist circumference, $F(1, 16) = .478$, $p = .529$.

Table 2
Participant Characteristics

Characteristic	Dumbbell (n = 10) M (SD)	FreeMotion (n = 8) M (SD)	p (time)
Age (years)	20.8 (3.0)	20.3 (3.0)	
Pre-BMI (kg/m²)	24.0 (3.5)	23.1 (1.8)	
Post-BMI (kg/m²)	24.1 (3.2)	23.3 (1.9)	.351
Pre-WC (cm)	80.7 (7.7)	78.3 (6.7)	
Post-WC (cm)	79.2 (9.1)	78.2 (6.6)	.478

Note. WC = waist circumference.

1-RM Barbell Bench Press

A repeated measures ANOVA compared the 1-RM barbell bench press and 1-RM barbell back squat values between groups. A significant effect was found in both groups over time, $F(1, 16) = 57.086$, $p < .001$, for the 1-RM barbell bench press (Table 3). However, no significant Group × Time interaction was found between the dumbbell and FreeMotion groups, $F(1, 16) = 1.778$, $p = .201$. This supports the hypothesis that no significant differences in upper body strength gains between dumbbell and FreeMotion groups would be found. The mean overall strength gain for the 1-RM barbell bench press was 12% (SD = 7.9, range = 5–38).

Mean values and standard deviations of 1-RM barbell bench press and 1-RM barbell back squat of both groups were inserted into Cohen's d effect size calculator (Soper, 2016), which determined the effect size of the 8-week strength training program. Cohen's effect size value was $d = 0.56$ was for the 1-RM barbell bench press, which suggests a moderate effect size in upper body strength gains.

1-RM Barbell Back Squat

Table 3 shows the comparison of 1-RM barbell back squat values between groups. A significant effect was found in both groups over time, $F(1, 16) = 89.118$, $p < .001$, for the 1-RM barbell back squat. Like the 1-RM barbell bench press, the 1-RM barbell back squat between the dumbbell and FreeMotion groups had no Group × Time interaction, $F(1, 16) = .056$, $p = .816$. These data support the hypothesis

that no significant differences in lower body strength gains between dumbbell and FreeMotion groups would be discovered. The mean overall strength gain for the 1-RM barbell back squat was 20% (*SD* = 11.7, range = 7–38). For the 1-RM back squat, Cohen's effect size value was *d* = 0.73. This indicates a moderate to large effect size in lower body strength gains for both modes of training.

Table 3
Pre- and Post-1-RM Strength Values Between Dumbbell and FreeMotion Groups

Exercise	Dumbbell (*n* = 10) *M* (*SD*)	FreeMotion (*n* = 8) *M* (*SD*)	*p* (time)	*d*
Pre-1-RM Barbell Bench Press (kg)	33.0 (9.5)	35.9 (7.7)		
Post-1-RM Barbell Bench Press (kg)	37.5 (9.1)	39.1 (7.8)	< .001	0.56
Pre-1-RM Barbell Back Squat (kg)	57.1 (14.0)	58.1(16.0)		
Post-1-RM Barbell Back Squat (kg)	67.0 (12.0)	68.6 (15.0)	< .001	0.73

Note. There was no Group × Time interaction (p = .201 for 1-RM barbell bench press and p = .816 for the 1-RM barbell back squat).

Discussion

The purpose of this study was to investigate the effects of different resistance training programs on strength of untrained college-age females using free weights and FreeMotion machines. The key finding in this study is that participants in both programs had significant improvements in strength over time, but there were no significant differences in strength gains between dumbbells and FreeMotion machine groups.

Primarily, past research has not reported significant differences over time in strength gains among people using different strength training modes (Ben-Sira, Ayalon, & Tavi, 1995; Boyer, 1990; Mayhew, Smith, Arabas, & Roberts, 2010). The results in this study concur with these findings. However, other studies have indicated that people may improve strength faster using machine weights versus free weights (Crone, 2011; Lennon, Mathis, & Ratermann, 2010; Mayhew et al., 2010). Also, there is support within the literature that improvements in strength are greater for people using free weights (Saeterbakken, Tillaar, & Fimland, 2011). Overall, previous litera-

ture regarding strength superiority among different resistance training modes has produced mixed findings.

An explanation for unclear findings on this topic could be that the specific exercises included in the programs for each group were inconsistent. Previous research has indicated similar exercises were included for each of the training programs (Anderson, Sforzo, & Sigg, 2008; Boyer, 1990; Colado et al., 2010; Lennon et al., 2010; Meek, Van Horn, & Schafer, 2008; Spennewyn, 2008). However, the exercises may not have been completely uniform for both groups. One mode of training may have led to superior strength gains in participants due to greater muscle activation during one or more specific exercises. In this study, the exercises were identical for the dumbbell and FreeMotion groups. The exercises in this study also progressed equally in sets, repetitions, rest time in between exercises, and tempo. None of the previous studies discussed the tempo of their exercises. Tempo is an important factor to include in a resistance training program because it prescribes the speed of each repetition (Sutton, 2012). If two or more groups perform the same exercises but with different tempos, they may observe differences in strength improvements.

The modes of resistance training that were compared served as a key strength of this study. Because of the similarities in load application and range of motion between dumbbells and FreeMotion machines, there was potential for comparable strength gains throughout participants' training. Both types of resistance training are controlled exclusively by the lifter and are capable of following an unrestricted range of motion. Also, the dumbbell and the FreeMotion machine allow the lifter to hold the resistance in each hand and perform exercises unilaterally if desired. Previous studies may have observed significant differences in strength gains because they compared modes of training that were dissimilar in load application (Cacchio et al., 2008; Saeterbakken et al., 2011)

The use of 1-RM testing on a barbell was another strength of this study. Because one group performed all of its exercises with dumbbells and the other used the FreeMotion machine, the barbell provided an unbiased method for testing each group's upper and lower body strength. If the study had included barbell exercises in the free weight group, the free weight group may have observed greater strength gains due to familiarization with the testing equipment.

Limitations were also present in this study. The participants may not have given their best effort on every workout day or on the 1-RM testing days due to their untrained status. An additional limitation to the study is that the participants may not have completed the workouts the way they were designed to be completed. The participants performed the workouts on their own, without supervision, although random spot checks were performed. Therefore, some participants may not have gone through the exercises properly with the correct number of sets, reps, rest time, or tempo. Participants may have tested significantly better after the 8-week period due to familiarization with the testing equipment and with how to perform a bench press and squat. No control group performed only the testing and no training, so there was no way to eliminate a testing effect. Videos were not recorded and electromyographic (EMG) analyses of the exercise sessions were not used in the study to verify muscle activation or range of motion.

Conclusion

The findings in this investigation are beneficial to strength and conditioning coaches, personal trainers, and other fitness enthusiasts who desire to obtain optimal improvements in strength. Training with the FreeMotion machine was found to be equally advantageous to training with dumbbell weights in terms of strength gains among untrained females. Physical educators, fitness trainers, or coaches who have untrained students, untrained clients, or athletes utilize FreeMotion machine exercises in place of dumbbell exercises may observe nearly identical strength improvements. Also, no injuries were reported for either group throughout the study. This study showed that if coached correctly with proper form, a progressive strength training program with either dumbbells or FreeMotion machines is safe for the participant. This study also added to the body of literature on resistance training with FreeMotion machines.

Because of the equivocal research findings regarding the superiority among strength training modes, continued research is needed. Further research is also needed on the FreeMotion machine. Furthermore, prospective studies should address tempo of exercises and rest time in between exercises. Including a larger sample size in future research designs would also assist in replication of results. This study utilized college-age participants, as is common in other studies

(Bellar et al., 2011; Boyer, 1990; Cotterman, Darby, & Skelly, 2005; Floyd, Otte, & Mayhew, 2009; Lyons, Mclester, Arnett, & Thomas, 2010; Saeterbakken et al., 2011). Inclusion of other age groups such as youth, middle-aged adults, or older adults would be important for future research studies.

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FITNESS

Physical Educators' Habitual Physical Activity and Self-Efficacy for Regular Exercise

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Abstract

The purpose of this study was to examine physical education teachers' habitual physical activity and self-efficacy for regular exercise. In-service physical education teachers (N = 168) voluntarily completed an online questionnaire that included items to collect demographic information (gender, race/ethnicity, years of teaching experience, and perceived weight status), self-efficacy, and habitual physical activity. The physical educators reported a high level of physical activity with an estimated total weekly MET-minutes > 3,000, and a relatively high self-efficacy for exercise. A multiple regression analysis showed years of teaching experience as a significant negative predictor ($\beta = -.35$, $p < .05$), but self-efficacy as a positive predictor ($\beta = .39$, $p < .05$) for physical educators' daily moderate to vigorous physical activity. These findings illustrate the positive role of self-efficacy for promoting physical activity participation, but indicate diminishing physical activity as a function of years of teaching experience among physical educators.

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In the United States, the national physical education (PE) teacher education standards (National Association for Sport and Physical Education [NASPE], 2008) and proposed revisions (Society of Health and Physical Educators [SHAPE America], 2016) emphasize, among other competencies, that physical educators should exemplify the characteristics of a physically literate individual. A physically literate individual possesses the knowledge, skill, and confidence necessary for a physically active lifestyle (SHAPE America, 2014). There is an abundance of literature concerning students' habitual physical activity (PA) and self-efficacy for participating in exercise, but no existing research has explored this relationship for PE teachers. Therefore, the purpose of this study was to determine PE teachers' habitual PA and self-efficacy for regular exercise.

From an occupational health perspective, PE teachers have been the focus of a few previous studies. Sandmark, Wiktorin, Hogstedt, Klenel-Hatschek, and Vingard (1999) examined the physical workload of 30 PE teachers and found the physical load on the lower extremities, back, and cardiovascular system was relatively high. More recently, Trudeau, Laurencelle, and Lajoie (2015) reported that although physical educators' absolute energy expenditure at work was low to moderate, they often had periods of vigorous PA. In summary, it seems the occupational aspects related to the PE teacher profession can generate episodes of moderate and vigorous PA. However, the total accumulated PA amount is not clear.

Although occupational PA contributes to overall PA participation (Bensley & VanEenwyk, 2011), high occupational PA levels are not necessarily associated with desirable health outcomes. For example, Holtermann et al. (2012) reported that high occupational PA might be associated with a higher rate of all-cause mortality, particularly among men with low leisure-time PA. Similarly, Bahls et al. (2015) reported that voluntary PA was associated with a reduced risk for all-cause mortality, but occupational PA was not. This suggests that the benefits of PA may differ depending on the type. As such, total habitual PA, including voluntary and occupational having different effects on health, warrants further investigation.

Self-efficacy has been identified as an important direct and indirect predictor for PA participation in a variety of populations (Dishman et al., 2005; McAuley et al., 2005). Based on social cog-

nitive theory, self-efficacy refers to a person's confidence in his or her capacity to execute behaviors or achieve a specific outcome (Bandura, 1997). According to Bandura (1994), human accomplishments can be enhanced by a strong sense of self-efficacy, and those individuals with strong confidence in their abilities approach difficult tasks as "challenges to be mastered rather than as threats to be avoided" (p. 1). Research regarding teacher efficacy has primarily focused on the association with positive teaching behaviors (e.g., trying new instructional ideas and/or better classroom management) and student achievement (Goddard, Hoy, & Hoy, 2004; Ross, 1998). No past study has reported teachers' self-efficacy in relation to their health-related behaviors such as engagement in habitual PA.

For PE teachers in particular, engagement in regular PA is not only a professional expectation (NASPE, 2008; SHAPE America, 2014), but also necessary for receiving health-related benefits of PA. As adults who interact with students in PA contexts regularly, physical educators are likely role models and/or significant adult figures in motivating children to participate in sports and PA (Warnick, 2009). Therefore, physical educators' self-efficacy and PA merit research from health and professional perspectives. Through examining physical educators' habitual PA and self-efficacy for regular exercise, this study represents an important initial step toward quantifying physical educators' total PA participation and identifying the contribution of self-efficacy, among other factors.

Method

Research Design

The study used a descriptive, correlational research design to report physical educators' self-efficacy, self-reported habitual PA, and the association between them. The institutional review board at the researchers' university reviewed and approved the study protocols.

Participants

Participants were in-service physical educators ($N = 168$) including 72.4% females and 27.6% males. The race/ethnic distribution of the sample was 93.9% Caucasian, 2.7% African American, 2% others, .7% Asian, and .7% Hispanic. Physical educators in this study had an average of 16.27 ($SD = 11.32$) years of teaching experience,

ranging from 1 to 40 years. Although most of the physical educators (75%) considered themselves to be of a normal weight status, 24.4% reported being overweight and 0.6% reported being underweight. Physical educators voluntarily participated in the study through an online survey platform.

Data Collection

Data collection commenced after the study protocols were approved by the university institutional review board. Once the questionnaires were developed and tested functional online, the researchers deployed and distributed the survey by sending it to several professional electronic mailing lists (e.g., PEcentral.com) and posting the recruitment letter and survey link on professional association websites (e.g., Society of Health and Physical Educators). The electronic mailing lists and professional association websites allowed the researchers to access a large pool of in-service physical educators in the United States in an economically efficient manner. Two measures were used to prevent participants from submitting the survey or taking the survey more than once. First, during the data collection process, an algorithm was built in to prohibit multiple submissions once the survey was open. Second, the researchers used statistical functions to identify potential duplicate cases from responses and recorded Internet protocol addresses.

A recruitment cover letter was sent through the electronic mailing lists and posted on the professional association websites. In the letter, the researchers explained the purpose, methods, and estimated time commitment for participating in the study. The inclusion criteria were that the participants had to be 18 years or older and serving as a full-time PE teacher. The cover letter also explicitly stated that participation in the study was voluntary. No incentive was offered in exchange for participation, and no name, e-mail, or school information was collected. Those who read the letter and decided to participate were encouraged to click a link to proceed with data collection, which occurred in spring of 2016.

Measures and Instruments

Demographic information. The online survey began with items collecting physical educators' demographic information such as gender, race/ethnicity, years of teaching experience, and perceived

weight status, whereby the participants identified their perceived weight status as underweight, normal weight, or overweight.

Self-efficacy for regular exercise. The second section of the online survey included the items of the Self-Efficacy for Regular Exercise Questionnaire (Bandura, 2006). For each of the 18 items, participants read a statement about a situation and rated their confidence in performing their exercise routine under a given situation. The confidence ratings ranged from 0 (*cannot do at all*) to 100 (*highly certain can do*). Sample statements describing a variety of situations include "When I am feeling tired," "During bad weather," and "When I am feeling under pressure from work." The aggregated composite was used to indicate physical educators' self-efficacy for regular exercise, which could theoretically range from 0 to 1,800. The Self-Efficacy for Regular Exercise Questionnaire displayed a high level of internal consistency with a Cronbach's alpha of .94 among physical educators in this study.

Habitual physical activity. The International Physical Activity Questionnaire-Short Form (IPAQ-SF) was used to measure physical educators' self-reported PA and sedentary time (Craig et al., 2003). The IPAQ-SF is a 7-day recall instrument that asks participants to report time spent in four PA categories and the number of days that they engaged in a typical week for each category: (a) walking/light PA, (b) moderate PA, (c) vigorous PA, and (d) sitting (i.e., sedentary time). Physical educators were asked to reflect upon all activities in which they typically participated within a week including occupational and other planned (e.g., exercise) and unplanned (e.g., housework) PA. Craig et al. (2003) tested IPAQ-SF for an adult population and reported acceptable reliability (ρ =.76) and concurrent validity (ρ = .67).

Data Analysis

Prior to statistical analyses, the IPAQ data were formatted using the following established guidelines (Craig et al., 2003): walking/light PA = 3.3 MET, moderate PA = 4.0 METs, and vigorous PA = 8.0 METs. Using these guidelines, the daily MET-minutes were calculated for light PA, moderate to vigorous PA (MVPA), and total weekly MET-minutes based on the online survey data for the participants. These variables represent participants' habitual PA for statistical analyses.

The researchers ran descriptive statistics on physical educators' self-efficacy for exercise, years of teaching experience, and PA variables. The 95% confidence interval (CI) for these variables was estimated using random sample bootstrapping. Then, the Pearson product–moment correlations were computed between physical educators' self-efficacy for exercise, years of teaching experience, and PA variables. Finally, the researchers conducted a multiple regression analysis with physical educators' daily MVPA as the dependent variable and their gender, race/ethnicity, perceived weight status, years of teaching experience, and self-efficacy as independent variables to determine the predictive value of these variables for physical educators' daily MVPA. Finally, based on the regression results, the researchers computed the effect size (f^2) to determine the predicting magnitude.

Results

Table 1 shows the descriptive statistics including mean, standard deviation, min, max, and 95% CI of the PA, self-efficacy, and years of teaching. On average, the physical educators demonstrated a daily sedentary time of 151.54 min, light PA of 60.62 min, MVPA of 56.11 min, and an estimated weekly 3,521.75 MET-minutes. Based on the average daily MVPA minutes and the estimated total weekly MET-minutes (> 3,000), the physical educators demonstrated a high level of PA participation. In addition, physical educators reported relatively high self-efficacy for exercise, M = 1127.05, SD = 362.76. Table 2 presents the Pearson product–moment correlation coefficients between PA, self-efficacy, and years of teaching. Physical educators' sedentary time had no or a low correlation with MVPA, total weekly MET-minutes, self-efficacy, or years of teaching. Weekly MET-minutes were highly positively correlated with daily MVPA (r = .85) and light PA time (r = .68). Self-efficacy demonstrated low to moderate positive correlations with weekly MET-minute (r = .27) and MVPA (r = .42). Years of teaching was negatively correlated with MVPA (r = -.31) and weekly MET-minute (r = -.32), but was not correlated with sedentary time or self-efficacy.

Table 1
Descriptive Results of Physical Activity, Self-Efficacy, and Teaching Experience

Variable	*M*	*SD*	Min	Max	95% CI
Sedentary (min·d^{-1})	151.54	102.68	10.00	540.00	[135.83, 165.92]
Light PA (min·d^{-1})	60.62	71.06	.00	400.00	[50.69, 71.42]
MVPA (min·d^{-1})	56.11	49.76	.00	270.00	[48.40, 64.18]
Weekly MET-minute	3521.75	2820.49	388.50	14958.00	[3114.50, 3991.79]
Self-efficacy for exercise	1127.05	362.76	291.00	1800.00	[1071.89, 1184.27]
Years of teaching	16.27	11.32	1.00	40.00	[14.53, 18.04]

Note. PA= physical activity; MVPA = moderate to vigorous physical activity; CI = confidence interval.

Table 2
Correlation Coefficients Between Physical Activity, Self-Efficacy, and Teaching Experiences

Variables	1	2	3	4	5	6
1. Sedentary (min·d^{-1})	1					
2. Light PA (min·d^{-1})	-.03	1				
3. MVPA (min·d^{-1})	-.07	.24**	1			
4. Weekly MET-minute	-.09	.68**	.85**	1		
5. Self-efficacy for exercise	-.18*	-.12	.42**	.27**	1	
6. Years of teaching	-.01	-.21**	-.31**	-.32**	.02	1

Note. PA = physical activity; MVPA = moderate to vigorous physical activity.

*$p < .05$. **$p < .01$.

In light of the high correlation ($r = .85$) between daily MVPA and weekly MET-minute, the researchers conducted a multiple regression analysis with physical educators' daily MVPA as the dependent variable and gender, ethnicity, perceived weight status, years of teaching, and self-efficacy as independent variables. As Table 3 shows, a significant amount of the variance in physical educators' daily MVPA was explained by the multiple regression model, $F(5, 139) = 10.22$, $p < .01$. Overall, the model explained about 24.3% of the variance in physical educators' MVPA. According to Cohen (1988), this result ($f^2 = .32$) indicates a medium to borderline large effect size ($f^2 \geq .35$). Years of teaching emerges as a significant nega-

tive predictor (β = -.35, p <. 05) but self-efficacy as a positive predictor (β = .39, p < . 05) of physical educators' daily MVPA. The other independent variables including gender, ethnicity, and perceived weight status were not significant predictors in the regression model.

Table 3
Multiple Regression Results Predicting Moderate to Vigorous Physical Activity (Min/Day)

	Adjusted R^2 = 24.3%, $F(5, 139) = 10.22$, $p < .01$				
Predictors	***B***	SE_B	β	***t***	***p***
Intercept	22.91	26.79	—	.86	.39
Gender	.02	7.96	.00	.00	.99
Race/ethnicity	-.32	5.31	-.01	-.06	.95
Perceived weight status	-.94	8.27	.01	-.11	.91
Years of teaching	-1.41	.32	-.35	-4.37	.00
Self-efficacy for exercise	.05	.01	.39	5.23	.00

Discussion

The purpose of this study was to examine PE teachers' habitual PA and self-efficacy for regular exercise. This study represents an important step toward quantifying physical educators' total PA participation and identifying the contribution of self-efficacy, among other factors. Results of this study provide empirical evidence about the role self-efficacy for regular exercise, as well as several sociodemographic factors, plays in predicting habitual PA among PE teachers.

The findings of this study demonstrate that self-efficacy for regular exercise can be an important factor in promoting PA participation among in-service physical educators. These findings are consistent with population-level studies that demonstrate a significant positive relationship between self-efficacy and habitual PA in other populations (Dishman et al., 2005; McAuley & Blissmer, 2000; McAuley et al., 2005). Bandura (1997) specifically referenced self-efficacy as a key to success in regular exercise and suggested that this construct is the preeminent determinant of consistent health-promoting levels of PA. Because physical educators should normally be aware of the health-related benefits of PA participation (occupational

knowledge), it is not surprising that the participants in this study had strong beliefs in their ability to be active and garner these benefits (Anderson, Wojcik, Winett, & Williams, 2006). According to Bandura (1997), self-efficacy is influenced by personal variables (e.g., age, gender) and environmental variables (e.g., social support). Further research examining the habitual PA and self-efficacy for regular exercise of in-service physical educators may consider exploring additional variables such as social support to further understand constructs that influence these health-related behaviors.

The physical educators in this study demonstrated high levels of PA participation. Because of the value placed on PA among physical educators and the knowledge, skill, and confidence associated with physically literate professionals (SHAPE America, 2014), it is not surprising that the participants were highly physically active. This finding is important because of the impact that a teacher as a role model can have on student populations (Klopfenstein, 2005). According to Conlin (2014), physically active teachers are recognized by their pupils as role models of physical literacy and can encourage youth to become physically literate when they move competently during classes. Furthermore, Senne, Rowe, Decker, Douglas, and Boswell (2006) found that teachers with active lifestyles can influence the PA of students. For these reasons, physical educators' engagement in PA and students observing these behaviors can act as important variables in influencing student activity. In this sense, physical educators can increase student PA participation not only through improving their own physical skills (Zhu & Chen, 2013), but also through showing their own PA behaviors, serving as a role model. Unfortunately, years of teaching experience acted as a significant negative predictor of PA, meaning that those who taught longer were likely to be less physically active. This suggests that while progressing through their careers, physical educators become less effective role models for PA behavior for their students, which is echoed in findings with professional sport role models (Mutter & Pawlowski, 2014).

Results from this study conflict with some population-level research in the United States pertaining to the effect of several sociodemographic variables on the habitual PA in adult populations. For example, population-level research in the United States has demonstrated that adult males tend to be more physically active than

adult females (Carlson, Fulton, Pratt, Yang, & Adams, 2015; Centers for Disease Control and Prevention, 2014). Additionally, nationally representative research demonstrates that PA is inversely associated with self-reported weight status among American adults (Pate, Ross, Liese, & Dowda, 2015). However, in this study, gender and perceived weight status were not significant predictors of the participants' PA. Occupational expectations associated with the PE teacher profession, such as work-related PA and/or fitness knowledge, may have contributed to these results.

Not only are physical educators likely to have a predisposition toward being physically active, but also their professional preparation requires that they acquire, refine, and demonstrate physical and sport skills that demand PA participation. Furthermore, professional knowledge (e.g., knowledge necessary to be a physically active individual) associated with the PE teacher profession (NASPE, 2008; SHAPE America, 2014) can also contribute to lessening PA differences among these population subsets. Previous literature suggests that physical educators tend to experience bouts of vigorous PA periods (Trudeau et al., 2015) and stress on the cardiovascular system (Sandmark et al., 1999) throughout the school day. These bouts of occupational PA, which are likely to be experienced by physical educators equally across gender and weight status, may obscure the differences among habitual PA levels between groups. Based on these factors, it appears that female physical educators, who reported comparable amount of PA with their male counterpart, have higher PA levels than regular female adults.

A number of limitations are evident in this study and may serve as a precaution for interpretation of the research findings. First, the study used IPAQ, a self-report instrument, rather than an objective PA monitor to measure PA. However, utilizing the self-report instrument allowed the researchers to gather data from a large number of physical educators in an economically and time efficient manner (Haskell, 2012). Second, the sample was limited to physical educators who volunteered to participate in the research and had the capability to access the online survey. Because of this, the results may not accurately represent the U.S. population of physical educators.

In light of these limitations, future studies should consider using objective PA measures to quantify PE teachers' occupational PA and

recreational or voluntary PA. Quantifying these two types of PA would help to further the understanding of the positive relationship between self-efficacy and PA that exists among PE teachers (Kruger, Yore, Ainsworth, & Macera, 2006). Additionally, future studies could look at self-efficacy, PA, and other health-related indicators to determine the relationship of these variables and help further the understanding of the occupational, health, and behavioral aspects of the profession. Because years of teaching experience is a negative predictor for PA, it would also be meaningful for researchers to examine the association between PA and longevity of teaching careers.

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PEDAGOGY

Exergaming: Comparison of On-Game and Off-Game Physical Activity in Elementary Physical Education

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Abstract

The purpose of this study was to describe fifth grade students' physical activity (PA) while playing a dance-based video game, Just Dance 4, and to examine the influence direct feedback about their performance had on their level of activity. Twenty-seven students in the 5th grade from an elementary school in the Rocky Mountain West participated. Participants wore a pedometer and recorded step count, PA, and moderate to vigorous physical activity (MVPA) while playing the game. Over 6 days of data collection, each participant collected on-game and off-game data for each song danced. Participants' mean step count was 1,891.63 (SD = 435.3) per class. The difference of total steps taken between on-game (M = 345.61, SD = 78.8) and off-game (M = 313.82, SD = 78.6) was not significantly different, t(27) = 1.50, p = .1289. Participants were physically active for a mean of 15 min, 40 s (SD = 174.63 s) and MVPA for 9 min (SD = 210.39 s). Although no significant difference was found between on-game and off-game PA, participants mean step count equated to nearly 16% of the daily recommended steps. Engaging in Just Dance 4 allows children to achieve part of the daily recommended PA in a 30-min physical education class.

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Physical activity (PA) contributes to a healthy lifestyle. Regular PA can provide numerous physical, social, and cognitive benefits to children such as improved muscular and cardiovascular health, increased health promotion knowledge and skills, disease prevention, and enhanced cognition (Janssen & LeBlanc, 2010; Keays & Allison, 1994; Strong et al., 2005). To achieve substantive health benefits, children should accumulate 60 min of moderate to vigorous intensity PA (MVPA) every day, which equates to approximately 12,000 steps/day (Colley, Janssen, & Tremblay, 2012). It is recommended that students take between 120 and 140 steps/min to reach MVPA levels (Graser, Vincent, & Pangrazi, 2009). Some research suggests that only 42% of children meet the daily recommended amount of PA (Troiano et al., 2008). Riddoch et al. (2007) determined that the median time spent in MVPA was only 20 min/day (boys: 25 min/day; girls: 16 min/day).

Physical education (PE) classes have the potential to increase levels of PA in school children effectively (Trost, 2006). It can also influence the overall PA they accrue over a typical day. For some elementary students, PA accumulated during the school day accounts for nearly 30% to 50% of their total daily activity (Cox, Schofield, Greasley, & Kolt, 2005; Gidlow, Cochrane, Davey, & Smith, 2008; Tudor-Locke, Lee, Morgan, Beighle, & Pangrazi, 2006). Although a relatively small amount of time during the school day is spent in PE, Alderman, Benham-Deal, Beighle, Erwin, and Olsen (2012) found that steps taken during PE accounted for nearly 12% of boys' and 10% of girls' total steps per day.

Although PE can provide the setting for PA, it is not clear if teachers design programs to maximize MVPA. For instance, in a review of research on elementary PE, Fairclough and Stratton (2006) reported that only 34% of available time in PE was spent in MVPA. This included activities such as ball games, fitness activities, games, and dance.

Dance and rhythmic activities may elicit higher percentages of MVPA than traditional activities. Huang, Hogg, Zandieh, and Bostwick (2012) found that students engaged in ballroom dance recorded MVPA for at least 50% of a class period. Exergaming, a form of dance or exercise performed while playing a video game,

has also been shown to be effective in increasing MVPA time (Fogel, Miltenberger, Graves, & Koehler, 2010).

Most dance-related exergaming research has been conducted on *Dance Dance Revolution* (*DDR*). Noah, Spierer, Tachibana, and Bronner (2011) found that *DDR* elicited in players a level of PA high enough to meet vigorous activity guidelines. Similarly, Tan, Aziz, Chua, and Teh (2002) reported a mean heart rate of 137 BPM for adolescents playing *DDR*. Exergaming may also contribute to sustaining longer periods of PA. Fogel et al. (2010) found that fifth grade students were active for over 90% of PE time while playing *DDR*. In a similar study, when 7- to 8-year-old children participated in a 10-week intervention study of playing *DDR,* results showed that PA increased by 42 min/week (Maloney et al., 2008).

The Xbox Kinect gaming system allows students to analyze their dance movements. The game *Just Dance 4* utilizes this technology and allows students to earn a score based on performance of the instructed moves and provides students the opportunity to be physically active. Although an entire class can participate in the game by mirroring the dance moves that appear on the screen, the game system is limited to providing instant feedback to only four students at a time. That is, only four students see their "scores" on the large screen (i.e., on-game). It is important for teachers to know if students can receive the same benefits when they participate on and off the game. Therefore, the purpose of this study was to describe fifth grade students' PA while playing a dance-based video game, *Just Dance 4*, and to examine the influence direct performance feedback from the game has on their level of activity. The specific objective of this research was to determine if PA levels were greater when students interacted directly with the game (i.e., on-game) than when they mirrored the actions but did not receive direct feedback (i.e., off-game) from the video game about their performance. The following questions were addressed:

- How many steps do students accumulate when playing the *Just Dance 4* video game during a 30-min PE class?
- How much MVPA is accumulated when students play the *Just Dance 4* video game during a 30-min PE class?
- Do students accumulate more steps when they receive direct feedback about their performance from the video game?

- Do students accumulate more MVPA when they receive direct feedback about their performance from the video game?

Method

Setting and Participants

This study was conducted at one elementary school in the Rocky Mountain West. Participants were 27 boys and girls (aged 10–11) in the fifth grade classes. The intervention (i.e., participating in exergames and measuring PA with pedometers) was conducted during regular PE class and had been implemented in the elementary school PE curriculum in previous and current years. Therefore, all 45 students in the class participated in the intervention, but data were only analyzed from the 27 participants who provided consent (parent/guardian and school principal).

Instruments

Just Dance 4 is a dance video game requiring participants to perform dance routines by mirroring moves displayed on a TV screen. The Xbox Kinect system is a motion sensing input device that allows users to control and interact with the gaming console without using a game controller. A built-in Web camera detects the student's movement and interprets those movements as if the student's body were a controller. The movements are analyzed and automatically assessed a score based on how accurate the movements are compared to the movements of the dancers displayed on screen.

The Walk4Life LS2525 digital pedometer was used to measure PA. The pedometer, an unobtrusive instrument about the size of a small matchbox, attaches to the participants' waistband and measures vertical movement. Pedometer measurements yield the participants' number of steps per minute, total activity time, and MVPA time count during a PE class. Pedometers have been shown to provide an objective and valid measure of steps taken in children (Beets, Patton, & Edwards, 2005; Schneider, Crouter, Lukajic, & Bassett, 2003) and for estimating activity (Beighle & Pangrazi, 2006; Rowlands & Eston, 2005).

Process

All students wore a pedometer while performing the dance routines. Prior to beginning the first dance, students cleared the pedometer (i.e., pressed the reset button). Pedometers recorded the number of steps taken during the dance routine for each song and were programmed to calculate time in PA and MVPA.

Students were divided into six groups; each group was assigned to one song of on-game activity per class session. This occurred across six class periods and students were on-game for a different song each day. When on-game, those four students stood in a designated spot in front of the Xbox Kinect to receive instant game feedback. The remaining students, who were off-game, were positioned in marked areas near the designated Xbox Kinect area, but did not receive instant feedback from the game.

After each song concluded, students recorded their PA data (i.e., step count, PA time, and time in MVPA) on a personalized record sheet (see Figure 1). Then students rotated to the next designated area and reset the pedometers in preparation for the next song. This process was repeated for all six songs each class session.

Physical Activity Record Sheet			
Name _____		ID number _____	
Song	**Step count**	**MVPA time**	**Activity time**
Everybody Needs Somebody			
Livin' La Vida Loca			
So What			
Good Feeling			
Rock N' Roll			
We Speak No Americano			

Figure 1. Student data recording sheet.

Description of Participants' Activities

Over 6 consecutive class days, students actively interacted with the game on six songs in the dance routine (see Table 1). The songs and dances remained the same for each class, and each student had the opportunity to be on-game for each of the six songs and dances.

Table 1

Sequence of Groups and Songs

	Song																																	
	Day 1						Day 2						Day 3						Day 4						Day 5						Day 6					
Group	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
1	■											■					■					■					■					■					
2		■					■											■					■					■					■				
3			■					■					■											■					■					■			
4				■					■					■					■											■					■		
5					■					■					■					■						■										■	
6						■					■					■					■						■					■					

Note. 1 = What Makes You Beautiful; 2 = Livin' La Vida Loca; 3 = Everybody Needs Somebody; 4 = Rock N' Roll; 5 = So What; 6 = We Speak No Americano. Gray boxes = on-game.

The songs selected and the length of each were "Everybody Needs Somebody" by Blues Brothers (3:15 min), "Livin' La Vida Loca" by Ricky Martin (3:37 min), "So What" by Pink (3:33 min), "Good Feeling" by Flo Rida (4:02 min), "Rock N' Roll" by Skrillex (3:50 min), and "We Speak No Americano" by Yolonda Be Cool (2:58 min). These songs were selected because of their upbeat tempo and the common length of time it takes to perform each. These songs and dances had been used previously in the PE class, so students were familiar with them and with the procedure for using the exergame system.

Data Collection and Analysis

Data were gathered after each class session and filed until all of the class sessions were complete. Once data were collected, steps, MVPA, and PA were entered into separate Excel spreadsheets. Data were organized for each participant by day, song, and on- or off-game. The mean was calculated for the number of steps taken and MVPA levels during each day of the study. The mean was determined by each participant's daily step count and MVPA divided by the number of days engaged in the study.

A *t* test determined the difference between on- and off-game steps and MVPA. Each participant's on- and off-game scores for steps and MVPA were averaged, which provided 27 data points. A *t* test was performed with these averages and determined the difference between on- and off-game steps and MVPA. Analyses were conducted in Excel, and a critical alpha level of $p < .05$ was adopted for all significance tests.

Results

Participants took a mean of 1,891.63 (SD = 435.3) steps/class, with a minimum of 1,347 steps and a maximum of 2,648 steps. Participants who were on-game took more steps per song (M = 346) than participants who were off-game (M = 314). However, the difference of total steps taken between on- (M = 345.61, SD = 78.8) and off-game (M = 313.82, SD = 78.6) was not statistically significant, $t(27) = 1.50$, $p = .1289$.

Participants were physically active for a mean of 15 min, 40 s (SD = 174.63 s). Only 9 min (SD = 210.39 s) were at MVPA. The amount of time spent in PA per song ranged from 96 to 218 s during

on-game play (M = 168.85, SD = 29.59). Off-game PA ranged from 83 to 203 s (M = 155.55, SD = 31.54). No significant difference was found between on- and off-game PA, $t(25) = 1.54$, $p = .1309$. The amount of time spent in MVPA per song ranged from 32 to 165 s during on-game play (M = 105.14, SD = 37.85). Off-game MVPA ranged from 25 to 145 s (M = 90.10, SD = 36.57). These differences were not statistically significant, $t(27) = 1.48$, $p = .1438$.

Discussion

The purpose of this study was to describe fifth grade students' PA by steps and MVPA while they played the dance-based video game *Just Dance 4* during PE classes. According to Stone, Faulkner, Zeglen-Hunt, and Bonne (2012), children are not meeting the daily recommended levels of PA. It has been recommended that children aged 6 to 12 should take more than 12,000 steps/day (Tudor-Locke et al., 2004). Cardon and De Bourdeaudhuij (2004) determined that 13,000 steps/day were needed to reach the equivalent of 60 min of MVPA. Griffiths et al. (2013) found that children only average 10,000 steps/day. Alderman et al. (2012) and Tudor-Locke et al. (2004) determined that PE could account for approximately 10% of the total steps children take each day. In this study, participants took an average of 1,900 steps/class session, which equates to nearly 16% of their daily recommended amount of steps per day.

Exergames can provide opportunities for children to be physically active in PE classes. The Centers for Disease Control and Prevention (2012) recommends that students should engage in MVPA for 50% of PE class time. From a review of 44 studies, Fairclough and Stratton (2006) reported that students were not meeting recommended levels of MVPA during PE and suggested interventions are needed to increase MVPA. In some studies wherein exergames were used (Fogel et al., 2010; Shayne, Fogel, Miltenberger, & Koehler, 2012), students spent as much as 90% of their class time in PA. Students in the current study were physically active approximately half of their time during PE. Although not meeting the 50% criterion proposed by the Centers for Disease Control and Prevention, students averaged 9 min of MVPA, or 30% of class time. Over 6 days of data collection, some students were very active, engaging in MVPA for 15 min (50% of PE), whereas others were less active (i.e., 2.3 min). These results

suggest that exergames such as *Just Dance 4* can be used as an effective intervention for increasing MVPA during PE.

Different methods of measuring PA have been used in exergame (Fogel et al., 2010; Maloney et al., 2008; Noah et al., 2011; Tan et al., 2002). In this study, pedometers were used to measure PA. On average, students were physically active for approximately half of the class time, spending one third of the class period in MVPA. Students in Gao, Podlog, and Huang's (2013) study used motion accelerometers while playing *DDR*. Gao et al. found that students were in MVPA for 30% of their class time. Yang and Foley (2008) used heart rate telemetry and reported students spending 80% of their class time in MVPA. Pedometers similar to the ones used in this study have been validated for estimating MVPA, but heart rate monitors could provide a more direct and accurate measure of PA intensity. PA estimates taken from pedometers are based on step count and may fail to account for increases in heart rate intensity associated with arm action and nonlocomotor movement. Future research should examine the consistency and validity of instruments used to measure PA during exergame play.

Exergames such as *Just Dance 4* provide students with instantaneous, positive feedback about their performance in the form of points and praise statements. According to Docheff (1990), the more positive and specific the feedback is, the more meaningful it will be to the participants and the more likely their PA will increase. Boyce, Markos, Jenkins, and Loftus (1996) posited that feedback should be immediate and related to the characteristics of the movement (i.e., direct, instantaneous, and congruent). Direct feedback did not seem to influence students' PA in the current study. The four on-game participants were the only ones to receive specific feedback from the game about their performance, yet off-game participants were as active as their on-game counterparts. Thus, children could be motivated to perform *Just Dance 4* because they enjoy playing the game and dancing to fun music, and enjoyment is more influential on their PA level than is the specific feedback they receive. Gao et al. (2013) reported that participants who enjoy the activity are motivated to participate to reach higher levels of PA. Thin, Brown, and Meenan (2013) found that Xbox Kinect, the system used in this study, provides high enjoyment ratings among participants. Further research

needs to examine how children's motivation and enjoyment affect their PA level while playing exergames such as *Just Dance 4*.

In summary, findings from this study suggest that elementary PE teachers may be able to use exergames such as *Just Dance 4* to increase students PA and MVPA. The small number of participants in this study limits the generalizability of these results; however, conducting additional research with a larger sample size is needed to ascertain if results can be replicated. One promising finding that needs to be explored further is the degree to which PA levels while children are playing exergames are dependent upon children receiving direct feedback about performance from the game. It is possible that enjoyment and motivation mediate the effect exergames have on children's PA.

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PEDAGOGY

"Like, We Don't Want to Be PE Teachers:" Preservice Classroom Teachers' Beliefs About Physical Education and Willingness to Incorporate Physical Activity

Jenny Mae Linker and Amelia Mays Woods

Abstract

The purpose of this study was to examine preservice elementary classroom teachers' (PCTs) beliefs about physical education and their willingness to incorporate physical activity as they progressed through an undergraduate physical education methods course. This course focused on quality physical education as well as the classroom teacher's role in school-wide physical activity and required participation in one of three laboratory experiences. Participants (33) completed either focus-group or individual interviews at the beginning and end of the course. Results indicated that PCTs' beliefs about physical education positively evolved through the course and PCTs gained an appreciation for the subject. Despite this, PCTs strongly indicated that they are not willing to teach physical education lessons as future teachers. They are very willing, however, to incorporate physical activity into their classrooms.

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Physical education (PE) should be taught by a state-licensed or state-certified specialist endorsed to teach the subject (SHAPE America, 2015). Studies comparing PE specialists and nonspecialists have shown that specialists are more likely to use effective teaching strategies and avoid less effective strategies, have greater amounts of student physical activity (PA), select activities that are more appropriate, and spend more time on motor skill acquisition and fitness development (Faucette & Patterson, 1990; Patterson & Faucette, 1990; Placek & Randall, 1986; Siedentop, 2009). Despite this, the percentage of states requiring elementary PE teachers to have licensure or certification decreased from 82.4% in 2010 to 71.4% in 2016 (SHAPE America & Voices for Healthy Kids, 2016*)*. According to the most recent *Shape of the Nation* report (SHAPE America, American Heart Association, & Voices for Healthy Kids, 2016), classroom generalists are also permitted to teach elementary PE in 31 states.

Beyond the possibility of having to teach PE, elementary classroom teachers (CTs) are called upon to be active participants in Comprehensive School Physical Activity Programs (CSPAPs) (Centers for Disease Control and Prevention, 2013). Proponents of the national Let's Move! Active Schools (LMAS, 2015) initiative encourage CTs to engage students in PA within their classrooms as part of the Physical Activity During School component within a CSPAP. Classroom PA may take several forms including, but not limited to, brain boosts (formally known as brain breaks) and academic lessons that incorporate PA.

Given that many preservice elementary classroom teachers (PCTs) are assigned to teach PE during their careers, and given the more recent call to contribute to school-wide PA, it is important to consider their beliefs about these roles, as their beliefs may strongly influence their perceptions and judgments, and ultimately affect their behavior (Nespor, 1987; Pajares, 1992). Specifically, these beliefs may serve as their foundation when they are planning PE lessons or classroom physical activities.

Beliefs

Teachers often teach specific content based on the values they hold for that content (Pajares, 1992). According to Pajares (1992), values combine affect (feelings toward the content) and evaluation and can determine the amount of energy teachers allocate to specific

content as well as how they will expend that energy. The foundation of a person's belief system holds personal backgrounds and experiences. Beliefs are mostly stable and unlikely to change unless they are proven unsatisfactory through experiences that challenge them (Pajares, 1992; Prawat, 1992). Last, the earlier a belief structure is developed, the more difficult it becomes to alter (Pajares, 1992).

Past school experiences significantly affect teachers' attitudes and dispositions toward preservice education and teaching, and teacher educators often encounter resistance from students who have been "socialized" prior to entering a teacher education program (Doolittle, Dodds, & Placek, 1993; Hutchinson, 1993; Lortie, 1975; Schempp & Graber, 1993). Lortie (1975) surmised that teachers enter teacher education programs with strong beliefs, noting that they already know what is needed to teach, because they observed teachers as they progressed through their pretraining, also termed *apprenticeship of observation*. Most research has shown that these attitudes and beliefs can be so strong that they are often maintained throughout teacher preparation programs (Carney & Chedzoy, 1998; Doolittle et al., 1993; Lortie, 1975; Rovegno, 1993; Tabachnick & Zeichner, 1984), but other research indicates that these ideologies may be malleable. For example, teachers have reported changes in their beliefs as a result of field experiences (Clarke & Hubball, 2001; Curtner-Smith, 2007; Xiang, Lowry, & McBride, 2002).

Physical Education Experiences of CTs and PCTs

Both CTs and PCTs have had generally poor PE experiences (Allison, Pissanos, & Sakola, 1990; Clayton, 1999; Howarth, 1987; P. Morgan & Hansen, 2008b; Portman, 1996; Randall & Maeda, 2003). Teachers and curricula have been the most frequently cited influencing forces on these prior PE experiences and have often included inappropriate practices such as public fitness testing (Randall & Maeda, 2003), public selection of team members (Howarth, 1987), overemphasis of competition (Randall & Maeda, 2003), and reinforcement of stereotypes (Allison et al., 1990) in the classroom. Some CTs also recalled their teachers yelling, making the class stressful, and ignoring unskilled students (Randall & Maeda, 2003). Classroom generalists have identified PE curricula as lacking variety and being dominated by sports and games with little

emphasis on motor skill development (P. Morgan & Bourke, 2008; P. Morgan & Hansen, 2008b).

Studies conducted during the late 1980s and through the 1990s described CTs' generally negative attitudes toward PE, as well as toward PE teaching (Faucette, Nugent, Sallis, & McKenzie, 2002; Faucette & Patterson, 1989; Howarth, 1987). However, researchers reported more positive attitudes toward the subject in the 2000s (Barney & Deutsch, 2009; P. Morgan & Hansen, 2008b). Mixed perceptions of the value of PE have also been found among CTs, with some citing it as valuable and others not (DeCorby, Halas, Dixon, Winthrup, & Janzen, 2005; Faucette & Patterson, 1989; P. Morgan & Hansen, 2008a; Xiang et al., 2002).

PCTs' beliefs about PE and their experiences in PE methods courses have been understudied. Existing literature reports that PCTs have had mixed beliefs about PE prior to completing a PE methods course and more positive dispositions have occurred during these courses (Ashy & Humphries, 2000; Curtner-Smith, 2007; Xiang et al., 2002). At the conclusion of a methods course, Xiang et al. (2002) reported that positive beliefs about the value and purpose of elementary PE significantly increased, whereas negative beliefs significantly decreased among PCTs. At the end of the course when participants were asked whether they would like to teach elementary PE (if given the choice postgraduation) however, only 27.8% of the 97 participants were categorized by the researchers as "willing to teach it," whereas 55.7% were categorized as "unwilling." Some (13.4%) were categorized as willing to teach PE under conditional terms such as only for a little while, as part of the regular classroom schedule, or only if they could not find a job as a CT (Xiang et al., 2002). This study found a general unwillingness of preservice classroom generalists to teach PE, but it is important to consider that it is only one role CTs may take regarding PA in schools.

Given the newer perspective to prepare CTs to incorporate PA beyond teaching quality PE, instructors may choose to integrate LMAS and CSPAP content knowledge into undergraduate PE methods courses for PCTs. Therefore, the purpose of this study was twofold: (a) to describe PCTs' beliefs about PE within a PE methods course that incorporated LMAS and CSPAP content, as well as how these beliefs differ across three laboratory experiences and (b) to

describe their willingness to incorporate PA as future classroom teachers.

Method

Research Setting

The study was conducted at a large Midwestern university where a 3-credit PE methods course is required for elementary education majors as part of the teacher certification program. This course consisted of a 2-hr lecture and one 2-hr laboratory each week for 14 weeks. The lecture was taught by one instructor, and a second instructor taught all three laboratory sections. Both instructors were doctoral candidates and PE teacher education specialists. The lecture instructor had taught laboratory sections of this course in previous semesters; this was her first semester teaching the lecture portion. The laboratory instructor had not previously taught the laboratory sections of the course. The investigators were not formally associated with the course.

The lecture portion of the course addressed the benefits of PA, characteristics of quality PE, appropriate and inappropriate practices, motor skills and concepts, and lesson planning. In addition, the instructor also incorporated LMAS, CSPAPs, and the role of the CT in elementary PE. Brain boosts were incorporated regularly throughout the 2-hr lectures.

During the laboratory experience, all students participated in elementary PE lessons designed by the instructor and were exposed to the same PE content knowledge and pedagogical content knowledge. Laboratories were altered in only one aspect to reflect three application conditions. The laboratory conditions were *teaching children, peer-teaching*, and *no teaching*. Participants registered for one of the three laboratory sections prior to the start of the study and were not aware of the condition assigned to their laboratory section prior to enrolling. Participants remained in the same laboratory section for all 14 weeks of the course.

In the *teaching children* condition, participants cotaught small groups of children and were responsible for planning and implementing a minimum of eight instant activities (activities used at the beginning of a class as a warm-up or review of skills) and two 30-min lessons. The children were ages 8 and 9 years and enrolled in an

on-campus after-school PA program. In the *peer-teaching* condition, each pair of students taught a small group of their peers a minimum of eight instant activities and two 30-min lessons. In the *no teaching* condition, students did not participate in teaching during the semester. Instead, they spent their laboratory experiences discussing eight instant activities and two 30-min lessons with peers. All students gave and received peer feedback on their planned activities.

Recruitment and Participants

After institutional review board approval was granted, all elementary education undergraduates enrolled in an undergraduate PE methods course for CTs were invited to partake in the study on the first day of lecture. Sixty-six PCTs were recruited, and from this pool, six were randomly selected from each laboratory to partake in the focus group interviews (18 total) and five were randomly selected from each laboratory to partake in individual interviews (15 total). Of the 33 participants, three were male and 30 were female.

Data Collection

Focus group interviews and individual interviews were conducted during the first and last weeks of the course during laboratory time. Interviews were audio recorded and transcribed. Participants were assigned pseudonyms to maintain anonymity.

Focus group interviews. Focus groups are useful in preliminary and follow-up evaluations and for hearing participants' experiences with a program (D. Morgan, 2008). They create an opportunity for participants to engage in thoughtful conversations about the topics of interest to themselves and the researchers. The same interview guide was used for the initial and final focus group interviews with slight modifications in grammar to reflect the time at which the interview was conducted. According to Patton (2002), the "same questions need to be asked in the same way" (p. 346), for a researcher to compare answers across different times. Special attention was directed toward the topics that consistently generated high levels of interest from most participants (D. Morgan, 2008).

Group interviews consisted of six participants from the same laboratory and occurred during the regularly scheduled laboratory time. Interviews occurred in a classroom within the same building as the laboratory and circular seating was employed. At the start of

each focus group interview, one of the researchers welcomed the participants, provided them with an overview of the discussion topics, explained the ground rules, and addressed participant questions before asking the first interview question. Initial focus group interviews ranged from 20 to 23 min, and those at the end of the course were 20 to 35 min in length. Participants were not required to answer all questions during the interviews.

Individual semistructured interviews. Semistructured interviews allow researchers flexibility to explore previously unanticipated topics of interest while keeping the core interview questions standardized (Patton, 2002). The semistructured interview guide began with general questions and progressively focused on specific research topics. The last question for each interview was, as recommended by Roulston (2008), "are there any additional comments you would like to make in regards to your experiences in the course this semester" (p. 582). Pre- and postinterviews consisted of the same open-ended questions (Patton, 2002). Additionally, the researcher expanded one question to accommodate emerging themes. During the initial interviews, all participants expressed an interest in implementing movement. To follow up on this theme, the researcher not only asked participants the extent to which they planned to use movement in their future careers, but also specifically how (movement breaks, interdisciplinary lessons, or complete PE lessons) and why, during the postinterviews.

Individual interviews were conducted during the regularly scheduled laboratory time in a classroom within the same building as the laboratory. Prior to commencing each interview, the researcher provided an overview of the interview topics and protocol and addressed participants' questions. Individual preinterviews were 10 to 13 min in length and postinterviews were 12 to 22 min long. Participants were not required to answer all questions during the interviews.

Data Analysis

The researcher read all focus group and individual interview transcripts three times prior to organizing responses by question and data collection point. Both data sources were then analyzed inductively. Within each type of data, the first stage was open coding of responses, for the researcher to identify as many ideas and con-

cepts as possible without concern for how they relate (Benaquisto, 2008). Through open coding of the data, constructs such as categories, statements of relationship, and generalizations were developed. Triangulation of themes and codes occurred through cross-data validity checks among the focus group and individual interview data. The researcher generated final codes and created a coding frame to define key concepts, their definitions, and criteria for recognition in the coding for each data source. The researcher adjusted these coding frames as needed to accommodate data that presented during the use of the constant comparison method (Patton, 2002).

To enhance the integrity of the qualitative analyses, the researcher employed several strategies. First, using the constant comparison method, the researcher purposely sought out negative cases that differed from working theories, to help protect against researcher bias in how data were seen and reported (Brodsky, 2008). Second, written memos were used to describe thinking processes during analysis. Memoing contributes to the credibility and trustworthiness of qualitative research, and there are no rules regarding writing, grammar, or style; however, each entry should be dated and referenced. Last, at the conclusion of the inductive analyses, a kinesiology, pedagogy doctoral candidate conducted an external audit. The auditor read all focus group and interview transcripts, formulated her own themes, and compared them to those of the investigators. Discrepancies in findings were not indicated.

Results

Results are represented through two major themes. The first theme describes participants' evolution of beliefs about PE through the methods course. The second theme describes the venues in which they are willing to incorporate PA as future CTs and their reasoning for incorporating it. Participants' quotes include the laboratory section enrolled (*no teaching*, *peer-teaching*, or *teaching children*) and indicate if they occurred in a focus group interview (FG) or individual interview (II). Last, pseudonyms have been used and all participant quotes have been reported verbatim with grammar errors intact.

Appreciation of Physical Education and Changed Beliefs

Participants expressed a change in their perceptions of PE across all of the laboratory experiences. This change in perception was based on an increased awareness of PE and its national standards and outcomes, as well as an understanding of the requirements necessary to teach quality PE. Participants acknowledged that contemporary PE is different from what they experienced when they were children, is not easy to teach, and is an important subject. Last, the PCTs credited their learning experiences in the lecture portion of the methods course for their changed perspectives.

Today's physical education is different. Participants made frequent comparisons between the knowledge gained through the course and their own PE experiences. Kara stated,

> I just see how bad my physical education was when I was younger. We would just play games all day and it was a free for all. I don't know, it's just more structured, and we didn't know what instant activities were until this. (*no teaching*, II)

Similar to Kara, others also mentioned a lack of structure in their learning. Amy stated,

> I think in general it [the course] gave me an idea of what P.E. is. We taught things that I was never taught when I was younger. We just played games. I mean, I remember learning how to bowl, or jump-rope, but never cue by cue. (*peer-teaching*, FG)

Additionally, participants cited specific inappropriate activities or games that were played in their past PE classes: "When I was little, we still played dodgeball and kickball and these days you're not supposed to be doing that" (Claire, *teaching children*, II). These comparisons revealed inadequacies and inappropriate practices in the participants' PE programs and allowed participants to recognize that past experiences may not have been appropriate models of PE.

It is not easy to be a PE teacher. At the end of the course, the PCTs conveyed an appreciation for PE and those who teach the subject. Their statements communicated recognition of the legitimacy of PE:

> If a person really wants to be an effective P.E. teacher there is a lot to learn and a lot of resources out there. You can't just sit

around and be like, "oh, we're gonna play tag for the whole period." You have to plan things out. You have to have the national standards and you have to have a goal to teach the students. (Lauren, *teaching children*, II)

Participants also acknowledged the challenges in teaching the subject:

I definitely look at it in a different way. It isn't just a joke job, it's definitely just as hard as being a classroom teacher, if not harder, because of all the stuff I never thought of. Like they don't have a classroom, they have a little office in the gym, they teach way more students, they sometimes don't have the right equipment. So yeah, it's definitely opened my eyes. (Melissa, *no teaching*, II)

It appears the PCTs' impression of PE evolved from a "roll out the ball" perspective to a perspective that the subject requires preparation and planning with aims to achieve its own set of student learning outcomes. In addition, the PCTs understood that to achieve this perspective of PE successfully, physical educators must be dedicated to this goal and capable of overcoming challenges not faced in the regular classroom.

Physical education is essential to a child's education. By the end of the semester, the PCTs expressed changes in their beliefs regarding the importance of PE and concluded that it was "essential to a child's education." Ashley verbalized,

I'll admit I used to think academics was more important than P.E., but I realize that P.E. is essential to a child's education. It influences everything else. Our kids have to be healthy. I do respect P.E. teachers more now. (*peer-teaching*, FG)

Michael affirmed this and emphasized the long-lasting impact elementary PE may have on a child's health:

There's a lot of interesting facts about obesity, and just statistics. I never really thought that elementary P.E. would be so necessary for students and for people in general. 'Cuz that's when they're kids, that's where everything starts

forming and happening. So if we get them there, then they'll start young. (*teaching children*, II)

For others, the reason for mandating a PE methods course in the curriculum for the elementary education major became more apparent:

> It never occurred to me before that you could have movement in a classroom; you don't just have to sit in a desk all day. Before I was wondering why they were making us take this class, like "we don't want to be P.E. teachers," but now I see how beneficial it is. (Anne, *peer-teaching*, FG)

Overall, participants recognized the importance of PE and its ability to influence children's well-being positively.

Lecture primarily facilitated participants' changed beliefs. When participants were asked to indicate which portion of the course had the greatest overall impact on their learning, most indicated the lecture. Additionally, strong affirmation responses were noted from participants across all laboratory sections when asked about the extent to which the lecture portion of the course influenced their thoughts and feelings regarding PE. Aspects of lecture most cited for influencing their overall perceptions were obesity statistics, "Hall of Shame" articles (Williams, 1992, 1994, 1996) and discussions, and research associated with the importance of PA:

> Some of the stats that we looked at were really shocking about obesity and children who are overweight. I never thought about PE even though I'm in the education program but it never hit me - maybe I have some responsibility for teaching children about physical activity and stuff. (Jenna, *peer-teaching*, FG)

Adrienne discussed content from the "Hall of Shame" articles:

> I never realized games like dodgeball or elimination games were that bad. I just kind of played them. I never really thought about the whole aspect of someone getting eliminated, which is a bad thing or having humans as targets. I just thought of them as part of the game. (*teaching children*, FG)

Last, Andrea cited research on PA, "Probably lecture again, because we talked about why it was important and what would happen if we didn't have P.E., and the importance of 60 minutes a day" (*peer-teaching*, II). Lecture components regarding the obesity pandemic, inappropriate curriculum, and PA research were presented during the first two weeks of the course. It is apparent that these components resonated with the PCTs and affected their beliefs about PE.

I'm Willing to Implement Movement in My Classroom

The second major theme describes PCTs' willingness to teach PE lessons and incorporate PA into the classroom. At the conclusion of the course, the PCTs overwhelmingly expressed their unwillingness to teach full PE lessons in their future careers and often explained that they "did not want to be a physical education teacher." For example, Quinn stated, "I would never want to teach P.E." (*peer-teaching*, II). Shannon exemplified this theme, but conveyed her interest in understanding schools' PE programs: "So it's something. I want to be a classroom teacher, not a physical education teacher. But at the same time, I'm gonna want to know what they are doing in there and incorporate activities into my classroom" (*peer-teaching*, II). It is important to note that the course lecturer had informed the PCTs that they might be required to teach complete PE lessons to their future students. To support this notion, she cited one of the university's hometown school districts where there are no elementary PE specialists. The potential future responsibility of having to teach PE did not seem to influence their willingness to do so.

Although the preservice teachers did not indicate a willingness to teach PE lessons, they unanimously reported that they were willing to implement movement activities within their future classrooms, during pre- and postinterviews (23 responded affirmatively to this question in preinterviews and 29 during postinterviews). During postinterviews, participants were asked to predict how this implementation would occur, either in the form of movement breaks, interdisciplinary lessons, or complete PE lessons. Of these 29 respondents, only three indicated that they would integrate all three forms of movement implementations. Overall, participants were more willing to implement movement within the classroom learning environment; 11 indicated movement breaks and interdisciplin-

ary lessons, nine indicated movement breaks only, and six indicated interdisciplinary lessons only. Examples of PCTs' responses are as follows: "I'm planning on doing movement breaks. Even during lecture, you need that three minutes to jump around and laugh" (Anne, *peer-teaching*, FG). Andrea and Lauren reported,

> I'd probably use movement breaks the most, it's the easiest and most practical thing to do. But if there was a lesson plan that I thought would help a certain subject, like getting them outside, it would help because they get more excited and focus more. The issue is getting something practical to do. (Andrea, *peer-teaching*, II)

> If I was able to, I would like to take the kids and go outside and do things too. If I could, if the school allowed me to do like 30 minutes outside. If they didn't have P.E. and the school allowed me to do 30 minutes outside, I would do that and take advantage of that. So yeah, I would. (Lauren, *teaching children*, II)

The law of conservation of energy applies to the classroom. The law of conservation of energy states that the amount of energy in a system remains constant over time. This energy may change forms but cannot be created nor destroyed. The PCTs in this study saw movement as a way to regulate the balance of energy within the classroom. This subtheme did not change over the semester as evidenced by pre- and postinterview data. At the beginning of the semester, 20 participants cited the benefit of balancing student energy levels as their primary motivation to implement PA in their future classrooms, and 26 did so at the end of the semester.

Using PA to balance student energy was split fairly evenly between the purposes of "energizing" and "de-energizing" students. PCTs were drawn to movement's ability to energize their students when they seemed mentally tired. Kevin stated,

> Yeah, I plan on doing the movement breaks like we do in lecture. They are a great idea I think. That's the kind of I thing I would do just in the middle of the day, when I see kids are dragging; just get up and have kids do something fun like she has us do. (*peer-teaching*, II)

Other participants cited movement as a way to "de-energize" students who were being "antsy" or "squirrelly":

> I know the kids I've worked with, first graders, they are just so "antsy." All the little boys, and even the girls, just want to get out and they're always asking to go to the bathroom so they can walk around and they're asking to go sharpen their pencil because they just need to get out of their seat. (Hilarie, *teaching children*, II)

> It's important for them to have a movement break so then they can calm down and pay attention and learn. Whereas, if I wouldn't give them time to play, they'd be all "squirrelly" and not listening. Yeah, kids need space. Kids need to move. (Kayla, *no teaching*, II)

The majority of the PCTs indicated balancing student energy as the primary benefit of movement implementation, but other reasons were also reported. Ten participants acknowledged the ability of movement to facilitate motivation for other subject content, during the postinterviews (compared to three during the preinterviews). Meg explained,

> For the research article, I did a research article on interdisciplinary lessons. They are really helpful for the kids, they are motivated so much more and they are able to connect abstract ideas so much more if they combine two things, especially with movement. (Meg, *teaching children*, II)

Some participants (four preinterview and eight postinterview) also reported their enjoyment of participating in movement breaks when they were children and/or during the lecture portion of the current course as a reason to implement movement into their future classrooms: "I think it's kind of cool. Even when we were in lecture we would do those little instant activities or movement breaks. I just thought that was fun and it kind of made class seem more exciting" (Stephanie, *peer-teaching*, II).

At the end of the course, PCTs rarely mentioned children's physical health as a reason why they would incorporate PA in their future classrooms. This was unexpected given that the topic of childhood

obesity was thoroughly discussed in the course, and participants clearly expressed a concern for the obesity pandemic. Ashley was one of these anomalies: "You're moving but you're also having fun at the same time, so you don't even know that you're moving. You're doing something good for your body, but you're also enjoying yourself" (*teaching children*, FG).

Summary

PCTs' beliefs about PE evolved as they progressed through the methods course. Participants identified differences between how quality elementary PE was described in lecture and how they experienced PE when they were children. By the end of the course, participants had developed an appreciation for quality PE and concluded that it played an important role in the development of children. Last, although some participants cited the laboratory portion as having a greater impact on their learning experiences and beliefs about PE, the majority cited the lecture portion of the course as the primary influencer.

Participants in this study overwhelmingly indicated that they did not want to teach PE lessons, but were interested and willing to incorporate PA into their future classrooms. Most stated that they would do so through the use of brain boosts and interdisciplinary lessons. Furthermore, when asked to explain why they would incorporate movement in their future classrooms, PCTs most often discussed using PA to energize and de-energize students.

Discussion

The results of this study corroborate earlier findings that a PE methods course can positively affect PCTs' dispositions toward PE (Ashy & Humphries, 2000; Curtner-Smith, 2007; Xiang et al., 2002). Similar to elementary education majors in Ashy and Humphries' work (2000), PCTs in this study displayed an appreciation for PE and recognized the difficulties and challenges in teaching it. PCTs in this study credited the lecture portion of the course as being the most influential regarding their learning and beliefs about PE, as opposed to hands-on experiences during the laboratory. This differs from the study by Xiang et al. (2002), in which participants ranked teaching PE in an elementary school and observing PE classes as the two most influential components of a course of this type. This difference may

be due to the scope of content and varying instructional strategies included in each respective course.

This study extends work by Xiang et al. (2002), by reporting on PCTs' willingness to incorporate PA beyond traditional PE lessons. Similar to the preservice teachers in Xiang et al.'s study, PCTs in this study did not express a willingness to teach PE lessons. Participants indicated, however, that they were willing to incorporate PA in their future classrooms in the form of brain boosts and interdisciplinary lessons. This is encouraging for the LMAS movement, which calls upon CTs to contribute to school-wide PA efforts.

PCTs primarily viewed student movement as a way of energizing students who were tired or bored, yet as a strategy to calm and settle students who were "antsy" or "squirrelly." The valuable health benefits of PA were seldom provided as a reason to integrate movement into children's classroom experiences. This was surprising given that participants cited obesity statistics and PA research as influential agents of change regarding their beliefs about PE. Research on teacher concerns may help explain why these preservice teachers rarely mentioned positive health benefits as a reason to incorporate PA in the classroom. Teachers experience varying concerns as they progress through their careers, migrating from initial self related, to task related, and then to student related (Fuller, 1969; Fuller & Brown, 1975). Ashy and Humphries (2000) found that management (with a focus on student behavior) was the single most important issue of concern in a PE methods course for PCTs. Thus, because preservice teachers are likely preoccupied with self- and task-related concerns, rather than student-related concerns, it seems logical that they more frequently cited the use of PA to manage student behavior than the use of PA to improve student health.

Faculty offering a PE methods course for PCTs already face difficult curricular choices given their limited time with this group. Findings by Xiang et al. (2002) and this study raise the question of whether limited instructional time is best used to teach future generalists how to plan and conduct full PE lessons, when they have little to no desire to do so in the future. Alternatively, their interest and willingness to incorporate PA in the classroom may be left uncapital-

ized if not specifically addressed and developed. The results of this study support Hall, Little, and Heidron's (2013) proposed foci shift in these methods courses to one that seeks out the classroom professional as a partner in school-wide PA. Webster, Erwin, and Parks (2013) studied PCTs in a methods course with this particular foci and found, similar to this study, that PCTS are generally willing to integrate PA at the onset of these types of courses and that the number willing to do so increased at course completion.

To accommodate both perspectives, initial undergraduate courses for PCTs could address the role of CTs in a CSPAP and provide these students with elementary classroom field experiences in which they would implement physical activities such brain boosts and interdisciplinary lessons. These courses should still address the importance of quality PE and its characteristics, the distinction between PA and PE, motor skills and developmentally appropriate activities, and inappropriate and appropriate practices. Guiding CTs in how to plan and facilitate PE lessons may be best reserved for graduate-level courses or continuing education classes. Those charged with the responsibility of teaching the subject may be more invested to further develop their PE content knowledge and pedagogical content knowledge at this level. As established CTs, they may feel more comfortable than preservice teachers to expand the range of subjects they teach.

Additional research should continue to examine PCTs beliefs about PE and intentions to teach PE and incorporate PA in their future classrooms, as well as describe their experiences in these types of undergraduate courses. Research of this kind would help the profession establish guidelines regarding the foci of these types of methods courses. Future research should also employ methodology that allows for empirical comparisons of instructional strategies used in these courses. Additionally, a longitudinal approach to study the effects of methods courses on PCTs as they transition to and through their first several years of teaching is recommended. Studies of this type would inform faculty as to which instructional strategies produce long-lasting effects and help them optimize their limited time with this group.

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PEDAGOGY

Tactical Games Model and Its Effects on Student Physical Activity and Gameplay Performance in Secondary Physical Education

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Abstract

Many have examined game-based instructional models, though few have examined the effects of the Tactical Games Model (TGM) on secondary-aged students. Therefore, this study examined the effects TGM has on secondary students' physical activity (PA) and gameplay performance (GPP) in three secondary schools. Physical education teachers (N = 3) were trained extensively on the TGM; they then implemented 10 TGM lessons derived from the Tactical Games Approach textbook (Mitchell, Oslin, & Griffin, 2013) to secondary students (N = 123). Pedometers and Team Sports Assessment Procedure (TSAP) were used to measure students' PA levels and pre- and post-GPP, respectively. Fidelity was determined by Metzler's (2005) benchmarks for TGM and measured that teachers implemented TGM the majority of the time (93.5%). A one-way ANOVA and subsequent post hoc analysis found a significant difference between the average number of steps students took across all lessons for Teacher 1 (soccer; M = 60.7, SD = 17.5) and Teacher 2 (football; M = 55.8, SD = 20.0); Teacher 3 (handball) was not sig-

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nificantly different (M = 55.2, SD = 20.0). An independent t test examined step counts between gender, and repeated measures t tests examined GPP pre- and posttest scores. Secondary-aged females averaged significantly higher steps (M = 61.3, SD = 14.1) than secondary-aged males (M = 51.6, SD = 11.1). All GPP pre- and postmeasures were significantly different ($p < 0.01$) and indicated a significant improvement in GPP. TGM generated positive physical effects on secondary students. Although students were slightly missing the recommended 50% of class time in moderate to vigorous PA, the quality of moderate to vigorous PA or physical education learning indices should be considered.

Physical education (PE) is taught in many forms and variations. Some educators use curriculum or instructional models to aid instruction. Typically, these models are comprehensive and contain a theoretical foundation revolving around national standards. Researchers claim that when teachers utilize a standards and research–based model their overall teacher effectiveness and ability to reach content standards are more easily established (Metzler, 2005). However, many are simply teaching with a direct style or traditional method to teaching (Hastie, 2003). This approach, described as the technical skill-based approach, begins the lesson with a teacher-oriented demonstration and explanation of the skill taught that lesson, followed by teacher-led drills, and closing with a game offering students an opportunity to apply the skill learned. Bunker and Thorpe (1982) found students were unsuccessfully transferring skills taught during the drill segment and subsequently into gameplay. They also discovered that underperforming students were more likely to demonstrate hesitation in game activities if demonstrating poor performance in the drills. As a result, Bunker and Thorpe created Teaching Games for Understanding (TGfU), aiming to increase students' understanding of the game, tactical awareness, and development of game appreciation.

The TGfU instructional model offers freedom for the teacher during instruction and facilitated student learning. Researchers have explained, "The task of the teacher in TGfU is to present a game which children can enter with some of the skills already developed and that improvement can be achieved through understanding what the game is about" (Werner, Thorpe, & Bunker, 1996, p. 31).

This model, TGfU, made a pathway for other game-based instructional models to be developed. These are the Sport Education model (Siedentop, 1994) and the Tactical Games Model (TGM; Mitchell, Oslin, & Griffin, 2013).

The TGM (Mitchell et al., 2013) is a simplified version of TGfU utilizing modified gameplay and authentic skill practices to teach sport skills. Although the TGM instructional approach differs slightly from that of TGfU, the overall goal remains the same: to facilitate the development of game sense by placing students within modified gameplay and small-sided teams. As a result, students gain an opportunity to collectively and publicly share ideas, solve authentic problems (e.g., deciding where to send a birdie in badminton based on the position of their opponent), and possibly further increase their learning of the game.

A tremendous amount of research has been conducted on TGM among PE students. In the elementary setting, Nevett, Rovegno, Babiarz, and McCaughtry (2001) found offensive skills in students to improve significantly when teachers use the TGM instructional model. Empirical findings have also indicated TGM to increase students' perceptions on PE engagement and increase their enjoyment levels (Alison & Thorpe, 1997; Berkowitz, 1996; Wright, McNeill, & Fry, 2009) compared to a traditional approach. Additionally, Smith et al. (2015) found that elementary teachers using TGM significantly improved their students' overall physical activity (PA) levels. However, there is limited empirical evidence of the effects of TGM on secondary PE students. One study examined ninth grade PE students' perceptions of TGM and discovered students to be favorable toward TGM and learning sports skills during a PE lesson (Tjeerdsma, Rink, & Graham, 1996). Lee and Ward (2009) found tactical-focused instruction, as compared to traditional instruction, to improve supporting movements significantly in low-skilled female and male students and to improve supporting movements in average-skilled female students. Most recently, Harvey, Song, Baek, and van der Mars (2016) discovered that middle school students' PA activity levels were surpassing the suggested level of activity, that is, 50% of class time in moderate to vigorous PA (MVPA; Institute of Medicine, 2013). Qualitative studies conducted with college-aged students have documented teacher candidates to hold favorable perceptions of TGM (Gubacs-Collins, 2007).

TGM researchers have used a variety of methods to assess their participants. Many have developed their own assessment tools, facilitating an authentic evalution of students' gameplay performance (GPP) in a variety of sports (Blomqvist, Vänttinen, & Luhtanen, 2005; Gréhaigne, Godbout, & Bouthier, 1997; Gufierrez, Fisette, García-López, & Contreras, 2014; Nevett et al., 2001; Tallir, Musch, Lannoo, & Voorde, 2003; Oslin et al., 1998). The most common tools found in TGM literature are the Team Sport Assessment Procedure (TSAP; Gréhaigne et al., 1997) and the Game Performance Assessment Instrument (GPAI; Oslin et al., 1998). TSAP assesses GPP based on a tally system by examining students' on-the-ball movements (i.e., received ball, lost ball, successful shots). GPAI evaluates game performance behaviors that demonstrate students' tactical understanding, including decisions made, skill execution, and support. According to Memmert and Harvey (2008), a number of limitations exist for the use of the GPAI in evalutions of student performance, the most notable being the lack of description GPAI provides the observer for identifying off-the-ball movement and the disparity the observer experiences when deciphering an appropriate or inappropriate off-the-ball action (Memmert & Harvey, 2008).

Some believe a curricular model is only effective if it promotes high PA levels among the other aforementioned PE-related learnings. Pangrazi, Beighle, and Sidman (2003) suggest 1,200 to 2,000 steps is a reasonable number for an active 30-min PE class. Others have indicated this to be a requirement for a lesson to be dignified as a quality PE lesson (Corbin & Pangrazi, 1998; Fairclough & Stratton, 2005; Simons-Morton, 1994). According to Scruggs (2007) and Scruggs, Mungen, and Oh (2010), reaching 50% of MVPA for secondary students is equivalent to 82 to 88 steps/min (seventh to eighth grade) and 82 to 83 steps/min (ninth to 12th grades), respectively. If a model can only raise PA without offering or satisfying other PE standards, the PE program may be considered no better than free play, which reduces its legitimacy as a well-rounded subject area. Therefore, TGM and the effects on learning (e.g., cognitive or psychomotor improvements) and student PA should be examined conjointly. This offers teachers and administrators viable information on the effectiveness of the model. To date, only Smith et al. (2015), Miller et al. (2016), and Harvey et al. (2016) have examined

the effects that TGM has on students' PA. These researchers used accelerometry and the System for Observing Fitness and Instruction Time (SOFIT; McKenzie, Sallis, & Nader, 1991) to examine PA levels. However, only Miller et al. examined effects of the TGM on promoting PA and another PE learning index.

The purpose of this study was to examine the effects of TGM on secondary students' PA and GPP across various schools, units, and age ranges. This unique approach aims to offer a realization of effects absent of contextual factors. The outcome of this study will offer administrators and curriculum developers further evidence on game-based approaches, more specifically TGM and its effects on secondary students' PA and GPP.

Method

Procedures

Teachers were asked to implement 10 sequential TGM lessons into their PE classes. Specific lessons were selected from the TGM textbook (Mitchell et al., 2013) and provided to teachers prior to commencement. The team handball unit lessons were modified following the soccer chapter, as team handball is not located in the text. This was an adequate unit selection with both being invasion games with similar tactics and design. All lessons followed Metzler's benchmarks: (a) modified gameplay with small-sided teams (3 vs. 3 and 4 vs. 4), (b) authentic practicing using passive defenders and minimal lines, and (c) critical thinking period using the guided discovery teaching style.

One day of training was provided to teachers before the study. The teachers had marginal experience and knowledge with the TGM before this study and training period. During the training period, researchers explained and described the model, demonstrated quality lessons, and provided video-recorded examples to the teachers. They also answered the teachers' questions and offered them additional support throughout the study. The researchers answered teachers' questions via e-mail or in person and provided them with visual demonstrations to clarify drills, which sometimes occurred on-site before each implemented lesson.

This study was approved by the institution's institutional review board and the participating school district, before the study. Parents'

and teachers' informed consent for their participation was also provided and collected before the start of the study. Names of school, teachers, and students were kept anonymous to protect their identity.

Participants and Settings

Teachers. Participating teachers (N = 3) were recruited and selected based on availability, in three northeastern United States school districts. Teachers' teaching experience averaged 13.01 (SD = 10.70) years. Teacher 1 (soccer) and Teacher 3 (team handball) had access to either a large field outside or a full indoor basketball court. Teacher 2 (football) had access to a full indoor basketball court. Class periods lasted between 48 and 51 min including time allotted for dressing into PE-appropriate attire. Each teacher taught a warm-up prior to implementing the TGM lesson. Units selected were based on the teachers' predesigned sequenced curricular plan.

Students. One hundred twenty-three students participated in this study. Teacher 1 selected two classes (n = 49), Teacher 3 selected two classes (n = 54), and Teacher 2 selected one class (n = 20) in which to implement the 10 sequential TGM lessons. Among the five PE classes, students identified their ethnicity as Caucasian (56.1%), Asian (17.1%), Hispanic (17.1%), Arab American (8.1%), and African American (1.6%). Students' ages ranged from 13 to 18 years old with an average of 15.3 (SD = 1.5) years old. Teacher 1 used 12th graders, Teacher 3 used ninth graders, and Teacher 3 used eighth graders. Prior sports experiences and skills varied among students, and the invasion game units selected were not taught that current academic year.

Assessments

Gameplay performance. The TSAP by Gréhaigne et al. (1997) assesses individual performance in team sports. In this study, this tool assessed students' pre- and post-GPP. The TSAP is based on a tally system and examines students' on-the-ball movements. The assessment has the following categories: (a) conquered balls (CB), whereby a player intercepted a pass, stole from an opponent, or recaptured the ball after an unsuccessful shot; (b) received balls (RB), whereby the player received the ball from a partner; (c) lost balls (LB), whereby the player is considered having lost the ball when an opponent steals or intercepts the ball; (d) neutral balls (NB), a routine ball to a part-

ner whereby the player passed the ball to a partner but did not truly put pressure on the other team; (e) pass (P), whereby the player displaces the ball toward the opposing team's goal; and (f) successful shot (SS), whereby the player makes a shot. From these variables, students' Volume of Play (VP) = CB + RB, Efficiency Index (EI) = (CB + P + SS) / (10 + LB), and Performance Score (PS) = (VP/2) + (EI x 10) were calculated based on the procedures from the TSAP (Gréhaigne et al., 1997).

Video recordings of pre- and post-GPP were taken to offer researchers an opportunity to document GPP accurately. Pre-gameplay assessment occurred 1 day before the 10 sequential lessons, and postassessment occurred immediately after completion of all lessons. During pre- and postassessment, video recordings occurred that captured students playing in modified games following TGM characteristics (i.e., small-sided games, modify rules, etc.).

Pedometers. Yamax Digi-walker DW-200 pedometers were used to record student PA. This assessment method was selected due to the accessibility of these devices as well as objectivity to assess students' PA for each lesson. Pedometers have been identified as a valid tool for evaluating children's step counts in PE (Sinard & Pate, 2001).

At the beginning of the study, students were assigned a specific pedometer and offered instruction on how to wear it. Multiple practice lessons occurred before the TGM lessons so the students and teachers could familiarize themselves with the process of using the pedometers.

Students were asked to calibrate their assigned pedometer after the warm-up, that is, to strap on the pedometer to their waistband in line with their knee, clear the pedometer, and take 20 steps. If the pedometer did not read 20 steps, students were instructed to situate the pedometer on the waistband, clear the device, and try again until 20 steps were recorded. After each lesson, a researcher collected and documented each student's steps.

Teacher fidelity. A research team member was trained and collected teacher fidelity to the TGM and pedometer data every lesson. The fidelity checklist was based on Metzler's (2005) benchmarks for faithful implementation of the TGM. An example of one instruction question includes, "Students are given time to think about deductive questions regarding the tactical problem" (Metzler, 2005, p. 423). All

lessons were observed, and the researchers found that teachers were implementing the TGM successfully and reaching all benchmarks the majority of the time (93.5%).

Interobserver reliability. Training and practice of TGM evaluation occurred among coresearchers before the study. Researchers observed TGM lessons and independently recorded teachers' fidelity and then compared results. Interobserver agreement (IOA) reached above 90%, surpassing minimum levels of agreement (van der Mars, 1989).

Data Analysis

Data reduction was performed in SPSS (Version 23, Chicago, IL). Initial descriptive statistics of means, standard deviation, and individual *z* scores were performed on students' PA and GPP data. A one-way analysis of variance (ANOVA) with Tukey post hoc was performed to determine any significant differences in the average number of steps taken by the students between the three sports lessons/teachers (soccer, football, handball). In addition, an independent samples *t* test was performed and examined whether there was a significant difference between female and male students on the average number of steps taken. These first two analyses examined the effects of the TGM on students' PA. In all cases, alpha was set at 0.05.

For this study, evaluation of PA levels using pedometers was quantified into MVPA, which was compared to previous research. Therefore, based on Scruggs et al.'s (2010) validation cut-point scale for pedometer steps to MVPA, approximately 82 to 88 steps/min would reach the MVPA guideline of 50% of class time.

To determine the effects of the TGM on GPP, the researchers performed three repeated measures *t* tests between pre- and postinterventions on Volume of Play (VP), Efficiency Index (EI), and Performance Score (PS). A one-tailed test was used, as it was expected that the the posttest measures would yield greater outcomes. Alpha was set at 0.05.

Results

Five PE classes with three teachers, each from a different school district, were included in the study. Three students' data were removed from the analysis for various reasons; one participant had

an extreme score on the number of steps per minute (z = -3.1), another attended only three of the 10 sessions, and the third did not attend any sessions.

Physical Activity

On average, TGM lessons from the three teachers lasted approximately 31 min. The average steps per minute for all students was 59.8 (SD = 13.7). Of the three groups, the students of Teacher 1 (soccer) had the highest average steps per minute (M = 60.7, SD = 17.5), with the teacher teaching TGM for approximately 34 min; the classes of Teacher 2 (football) had an average 55.8 (SD = 20.0) steps/min, with the teacher teaching approximately 32 min of TGM; and the students of Teacher 3 (team handball) had an average of 55.2 (SD = 20.0) steps/min, with the teacher teaching 31 min of TGM (Figure 1).

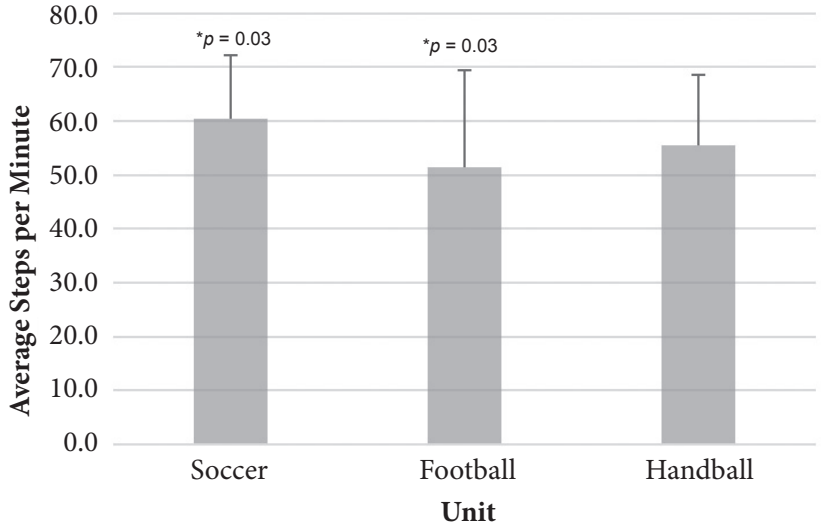

Figure 1. Average steps per minute for three groups.

A significant difference was found following ANOVA calculations between teachers on the average number of steps, $F(2, 118) = 3.61$, $p = 0.03$. Tukey post hoc analysis indicated a significant difference ($p < .05$) only between Teacher 1 (soccer) and Teacher 2 (football). Specifically, the average number of steps for students with Teacher 1 (soccer) was significantly greater than the average for students with Teacher 2 (football) by approximately 9.0 steps/min.

The average number of steps for all females (N = 66) was 61.3 (SD = 14.1) compared to all males (N = 55) with an average number of steps of 51.6 (SD = 11.1). An independent t test indicated that the females had a significantly higher average number of steps per minute than the males by 10.3, $t(119) = 4.14$, $p < 0.01$.

Gameplay Performance

The repeated measures t test comparing average pre- and post-VP measures found a significantly greater VP after the intervention, $t(23) = 5.1$, $p < 0.01$. The average VP score increased from 4.96 (SD = 1.85) preintervention to 7.32 (SD = 3.20) postintervention, for an increase of 2.37. The average EI score also significantly increased, $t(23) = 2.04$, $p = 0.02$, from 0.48 (SD = 0.21) premeasures to 0.59 (SD = 0.27) postmeasures; postmeasures on EI were on average 0.11 greater. Finally, the PS pre- and postmeasures were significantly different, $t(23) = 3.5$, $p < 0.01$. The average posttest performance score of 9.63 (SD = 4.08) was 2.43 greater than the pretest score of 7.20 (SD = 2.65).

Discussion

In this study, students reached an average count of 59.82 (SD = 19.18) steps/min and significantly improved their GPP in all three categories (VP, EI, PS). According to the U.S. (Institute of Medicine, 2013) recommendation for student PA in PE, students should reach at least 50% of class time engaged in MVPA. Students missed the recommended guideline for PE by approximately 23 steps/min, but a growing number of studies on game-based models have documented better success (Miller et al., 2016; Smith et al., 2015; Yelling, Penney, & Swaine, 2000), which signals inconsistent findings. In this section, we attempt to explain our findings and raise the notion that PE instruction should focus not only on PA but also on the attainment of other PE learning aspects concurrently.

Some believe an instructional model should not only promote PA but also help students to obtain additional standards-based learning areas in PE. For example, Fairclough (2003) explained that the criteria to judge the effectiveness of a program must exceed the notion of getting students active. If researchers or PE teachers solely focus on attainment of high PA, the field may revert once again to the findings by Placek (1983), who found that teachers perceive

quality PE as nothing more than organizing recess. In this study, students significantly increased their GPP in all areas (VP, EI, PS), satisfying the learning component found in national standards (i.e., SHAPE America National Standard 1: The physically literate individual demonstrates competency in a variety of motor skills and movement patterns). Students commonly miss the suggested MVPA guideline, regardless of the model implemented, according to the related literature. Kahn et al. (2002) performed a systematic review of all intervention studies during 1980–2000 and concluded that in the majority of interventions students were below the cut point of 50% class time in MVPA. However, many interventions found in this review (Kahn et al., 2002) demonstrated significant improvement in other PE-related outcomes (i.e., knowledge and skill development). Therefore, it may be concluded that these students were conducting quality PA during PE class time, rather than playing a game or recreational activity (e.g., capture the flag) that yields high PA with limited learning potential.

Recent studies have examined TGM specifically on the promotion of PA and found it to surpass the MVPA guidelines. United Kingdom- and Australia-based studies examined TGM effects on elementary students' PA levels (Miller et al., 2016; Smith et al., 2015). Conflicting results are documented in comparison to this study. Smith et al. (2015) discovered that 11–12-year-old boys had significantly higher MVPA than the condition group and reached the 50% criterion. However, girls' MVPA levels based on accelerometry were significantly lower than the level for the control and missed the 50% mark. No additional learning measures were taken to verify the models full capability (Smith et al., 2015). This study used pedometers and witnessed the opposite effects: Secondary-aged females engaged in more PA than secondary-aged males. The researchers recommend further examination on TGM and the effects on secondary students' PA based on students' gender for future research to find more conclusive outcomes. In a study among elementary students, Miller et al. (2016) documented similar results using SOFIT to evaluate PA; students improved gameplay decision making and support performance while reaching 50% of class time in MVPA.

Only Harvey et al. (2016) evaluated the effects of the TGM on the PA of secondary-aged students. They evaluated students from

one class during an eight-lesson soccer unit using McKenzie et al.'s (1991) SOFIT. Harvey et al. discovered that students were surpassing the 50% MVPA cut point; however, they did not assess additional learning outcomes. This, then, leaves questions regarding the quality of PA. From the Harvey et al. study, this study extends these results and offers evidence that TGM significantly increases GPP in all areas and promotes a moderate level of PA (59.82 steps/min). Past research documents that an active 30-min lesson should offer 1,200 to 2,000 steps (Pangrazi et al., 2003). Based on this notion, the overall step results in this study reached an active level, with approximately 1,794.6 steps/30-min lesson.

The lesson-by-lesson results (Table 1) show that a few lessons limited steps or PA compared to others. Teacher 1 (soccer) offered elevated steps for students in all but two lessons, Lesson 3 and Lesson 8, which both yielded 1,405 (41 steps/min) and 1,503 (44 steps/min), respectively. After reviewing these lessons and concepts taught, the researchers believe the limited steps may be from the introduction of novel tactics of the sport. The lower step count for these lessons dropped the overall average. Perhaps the teachers' limited content knowledge or unfamiliarity with TGM resulted in more time talking, demonstrating, or offering poorly constructed drills not conducive to high activity or repetitions. Additional scrutiny on specific lessons and construction of more active lessons should be considered.

Perhaps another factor that may have provoked limited PA for students overall is the lack of space or facilities for Teacher 2 (football). Teacher 2 (football) taught football indoors, in one gymnasium with a full-size basketball court. Despite the teacher designing small-sided games and authentic practice segments, space may have limited students' level of activity. This has been found to hold true; Bevan, Fitzpatrick, Sanchez, Riley, and Forrest (2010) found that when PE teachers have access to adequate equipment and facilities, students' PA levels significantly increase. Teacher 2 (football) obtained the active mark in five of the 10 lessons, but access to equipment and facilities is a common issue for urban schools that researchers should consider when evaluating any instructional model. Although no models apply to all settings, understanding the effects from the TGM instructional model based on contextual factors offers more useful information for curriculum developers, dis-

Table 1
Student Step Count per Lesson by Teacher

Lesson	Teacher 1 (Soccer) 34-min lessons[a] *M* (*SD*)	Teacher 2 (Football) 31-min lessons[a] *M* (*SD*)	Teacher 3 (Team Handball) 32-min lessons[a] *M* (*SD*)
1	2400.60 (491.91)	1181.36 (569.25)	946.30 (271.15)
2	1972.97 (523.10)	1522.29 (715.60)	2008.77 (623.25)
3	1503.68 (330.59)	1792.47 (424.42)	1903.95 (718.27)
4	2152.41 (522.03)	1813.19 (565.60)	2025.28 (528.11)
5	2119.19 (546.50)	2063.20 (958.80)	1689.34 (704.32)
6	2174.53 (536.11)	2097.50 (849.73)	1348.16 (477.09)
7	1874.39 (532.78)	1542.55 (561.82)	2138.16 (754.01)
8	1405.49 (426.02)	1332.00 (493.02)	1994.24 (914.74)
9	2420.97 (767.24)	1372.56 (591.65)	1797.64 (561.66)
10	2621.63 (751.01)	2589.83 (475.28)	1829.48 (858.50)
Total	**2064.58 (542.73)**	**1730.64 (620.52)**	**1768.13**
Steps/min	**60.72 (17.51)**	**55.83 (20.02)**	**55.25 (20.03)**

[a]*M* (*SD*).

trict administrators, and classroom teachers. Therefore, based on the findings in this study, TGM appears to be promising to help teacher maintain an active class while providing an educational (learning) aspect, despite the many factors and variations of teaching environments (i.e., different units, facilities, teacher teaching experience and experience with the TGM).

Conclusions

Based on the current study findings, TGM seems to provide a significant positive effect on GPP among secondary students. Although TGM facilitates an active level of PA, students missed the national recommendations for PA (Institute of Medicine, 2013). It is important to note that students were actively learning and developing GPP. PE teachers must maintain and reach dual objectives in PE rather than focus independently on either getting their students highly active or having their students learn at the sacrifice of activity. Further examination on secondary students in different units,

teachers' experience, and gender of the students, together with PA levels, may help determine the effectiveness of TGM on secondary students' learning outcomes.

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PEDAGOGY

In the Zone: An Investigation Into Physical Activity During Recess on Traditional Versus Zoned Playgrounds

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Abstract

Introduction: *The prevalence of childhood obesity in the United States has reached epidemic status with some states with rates as high as 20%. The most effective interventions for combating inactivity target children before inactivity develops in their adolescent years. If effective, school-aged physical activity (PA) interventions would decrease sedentary behavior and help combat childhood obesity. The main purpose of this study was to compare changes in PA of youth during recess following zoning of a traditional playground. A secondary purpose was to investigate which zones elicit the greatest levels of activity for boys and girls. A tertiary purpose is to compare observational measures of PA (SOPLAY instrument) to PA measured via pedometry.* **Method:** *PA for 364 boys and girls from two institutions were observed and recorded at recess with the System for Observing Play and Leisure Activity in Youth (SOPLAY) and pedometers. Baseline data were collected for 1 week on traditional playgrounds. After 1 week, the playgrounds were*

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zoned for specific activity, and PA was again observed and recorded. **Results:** *The average percentage of boys and girls considered to be very active increased by 10% following zoning, according to SOPLAY data. Average number of steps during recess also increased by a mean of 175 steps on zoned playgrounds versus traditional.* **Conclusion:** *Interventions, both within and outside of school, aimed at improving activity levels and changing behavior will help to quell the obesity epidemic. A zoned playground can be used as a simple and effective strategy that reduces sedentary behavior and increases activity during recess.*

Obesity is associated with an increased risk for cardiovascular disease, type 2 diabetes, and other chronic diseases (U.S. Department of Health and Human Services, 2001). Obese individuals have a higher prevalence of psychological disorders including depression, a higher prevalence of certain types of cancer, and earlier death (U.S. Department of Health and Human Services, 2001). Approximately one third of U.S. adults are currently obese (Ogden, Carroll, Kit, & Flegal, 2014), which has resulted in approximately $114 billion in medical costs annually (Tsai, Williamson, & Glick, 2011). Today's population of obese Americans developed from a baseline population of children and adolescents who are predominantly normal weight (Fox, 2004). Given that nearly one fifth of U.S. children are considered obese (Ogden et al., 2014), as many as 30% of their counterparts who are normal weight will also develop into adults who are overweight or obese (Guo & Chumlea, 1999; Roche, Guo, & Siervogel, 1993). According to the Centers for Disease Control and Prevention (CDC), the worldwide increase in childhood obesity has resulted from a milieu of behavioral changes negatively interacting with one another (Kersh, Stroup, & Taylor, 2011).

Although excess energy consumption and lacking daily energy expenditure can contribute to childhood obesity, modifications to physical activity (PA) seem more sensible than does limiting energy intake, considering a positive energy balance is necessary for proper growth and development during childhood (Butte, Christiansen, & Sørensen, 2007; Jebb & Moore, 1999).

The American Heart Association, American College of Sports Medicine, American Diabetes Association, and the CDC recommend that school-aged children (6–18) engage in at least 60 min of

moderate to vigorous PA every day, to prevent chronic diseases associated with overweight and obesity and achieve desirable health and behavioral benefits (Strong et al., 2005).

However, under half of children aged 6 to 11 are reaching the recommended 60 min/day, and as few as 8% of adolescents aged 12 to 18 achieve this goal (Troiano et al., 2008). Schools can provide the perfect environment for a controlled intervention, and it is one place where youth are present consistently and in quantity. The most effective interventions for combating inactivity target children before inactivity develops in their adolescent years (Kulinna, Brusseau, Cothran, & Tudor-Locke, 2012). If effective, PA interventions for school-aged children help decrease sedentary behavior and combat childhood obesity.

Recess is an ideal and appropriate time during a child's day to target improvements in their PA (Beighle, Morgan, Le Masurier, & Pangrazi, 2006; Gavarry, Giacomoni, Bernard, Seymat, & Falgairette, 2003; Guinhouya, 2012; Kulinna et al., 2012; McKenzie, Marshall, Sallis, & Conway, 2000). Literature measuring PA during recess is extensive and has uncovered several trends (Ridgers, Saint-Maurice, Welk, Siahpush, & Huberty, 2011; Ridgers, Stratton, Clark, Fairclough, & Richardson, 2006; Stratton, Ridgers, Fairclough, & Richardson, 2007). Most important, boys are consistently more physically active than girls, and PA levels decrease as children progress toward adolescence (Sallis, 2000). The age-related decrease is likely related to increased screen time and decreases in the amount of PA available to adolescents during school hours (Brownson, Boehmer, & Luke, 2005). Researchers have also investigated ways to increase activity during recess (Blaes, Ridgers, Aucouturier, Berthoin, & Baquet, 2013; D'Haese, Van Dyck, De Bourdeaudhuij, & Cardon, 2013; Howe, Freedson, Alhassan, Feldman, & Osganian, 2012; Stratton & Mullan, 2005; Verstraete, Cardon, De Clercq, & De Bourdeaudhuij, 2006). The interventions used in these studies vary from providing additional gaming equipment and improved boundary markings (Blaes et al., 2013; Howe et al., 2012; Stratton & Mullan, 2005; Verstraete et al., 2006) to limiting or decreasing playground population density (D'Haese et al., 2013).

Freedom of choice is a key factor in children's development of autonomy (Grossman, n.d.). When offered choices, children have

the opportunity to practice independence and responsibility while their health and safety is guarded by options that are controlled and monitored (Grossman, n.d.).

Zoned playgrounds are designed to facilitate activity that is governed by the participating students, rather than a member of the recess staff, which provides freedom of choice. Zoning a playground involves dividing the existing recess area into distinct zones. Each zone has a specific activity associated with it and additional equipment when necessary. Sedentary behaviors are removed as an option within the newly zoned playground. When sedentary behavior is removed as an option and a multitude of physically active choices are provided, an increase in PA is expected.

An insubstantial quantity of literature exists showing improved PA at recess with structured interventions (Howe et al., 2012; Maxim, 1997; Rowe, Schuldheisz, & van der Mars, 1997); however, no study has systematically and thoroughly investigated the impact of zoned playgrounds. In addition, no study has combined objective and observational measures of PA for zoned playgrounds.

The main purpose of this study was to compare changes in PA of youth during recess following zoning of a traditional playground. A secondary purpose was to investigate which zones elicit the greatest levels of activity for boys and girls. A tertiary purpose was to compare observational measures of PA to PA measured via pedometry.

Method

Participants and School Recruitment

Three hundred sixty-four (n = 364) third, fourth, and fifth grade students from two schools participated in the study. School A was a private institution with a similar percentage of boys and girls enrolled (85 boys, 75 girls). School B was a public institution comprising 111 boys and 93 girls. All assent and consent forms were approved by the University of Missouri institutional review board.

Instruments

Pedometers. A Walk4life Neo II (Plainfield, IL, USA) pedometer was used to assess PA during recess on a randomly selected subset of students (n = 49) from both institutions. The pedometer was set to zero and clipped to the waistline of each student on the midline

of the thigh inferior to the anterior superior iliac spine. Pedometers were collected at the end of recess when the students lined up to reenter their classrooms. Students who did not accumulate at least 5 step count days pre- and postintervention were removed from the data prior to analysis (n = 7). Validity "step tests" were conducted twice per week and involved the researchers to walk 100 steps with each pedometer. Pedometers were attached to right hip and the steps were continuous and in a straight line. Pedometers not within 90% or 10 steps were replaced. The researchers used step counts to compare PA before and after the intervention and to validate the System for Observing Play and Leisure Activity in Youth (SOPLAY; McKenzie et al., 2000; Rowe et al., 1997).

System for Observing Play and Leisure Activity in Youth (SOPLAY)

All students (n = 364; including the 49 with pedometers) were observed and categorized through SOPLAY pre- and postintervention for 10 days. The system is based on momentary time sampling (McKenzie, 1991; McKenzie et al., 2000; McKenzie et al., 1991). Boys and girls were assessed separately through SOPLAY scans of target areas (zones) during recess. During the scans, the PA of each student in a zone was coded as sedentary (S; lying down, sitting, or standing), walking (W), or very active (V). These activity codes have been validated by heart rate monitoring and allow for estimation of energy expenditure rates (McKenzie et al., 2000; McKenzie et al., 1991). Trained observers conducted SOPLAY observations. Observer training followed the recommendations of SOPLAY and consisted of 2 days of training led by the principal investigator. The first day consisted of familiarization with criteria for activity classification, scanning technique (left to right, girls followed by boys), and scanning speed (1 child/s). The second day consisted of several hours of watching videos provided by the creators of SOPLAY via the Active Living Research website.[1] Observers in training watched and categorized the children in the videos and cross-checked their observations against the activity levels until they obtained three observations in a row that were within 80% of the known activity.

SOPLAY observations during recess occurred 5 min after the start of recess, which ensured that all students were on the playground.

[1]https://activelivingresearch.org/soplay-system-observing-play-and-leisure-activity-youth

After the first observer recorded activity levels from each zone, a second observer conducted a reliability check. Reliability checks were completed for 16 days, which exceeds the recommended minimum of 20% of the total observations (McKenzie et al., 2000). On the other days, the principal investigator categorized participants independently using SOPLAY. Two observations per recess were conducted on these days. Interrater reliability was calculated on a subset of 85% of the observations at baseline and 80% of the observations at postassessment. This was due to inclement weather, as a zoned indoor recess plan was not a part of the study design. Reliability calculations required two observers to collect SOPLAY data during a given recess observation. Reliability was calculated using percent agreement and kappa coefficient for the three SOPLAY categories.

Intervention

During the intervention, the existing playground space was divided into six activity zones (Tables 1 and 2). Activity zones were selected based on available adult facilitation, likelihood for vigorous activity (running, jumping, changing directions), student interest, and emphasis on inclusion and improvement versus winning and losing (Murray & Ramstetter, 2013). Activity zones varied slightly between schools because of playground layout and available equipment and were similar but not identical. At both schools, five zones were set up for students to utilize a variety of games and activities were designed to develop teamwork, cooperation, and leadership skills. In addition, one zone was set up with a walking track and/or balance builders.

Before postintervention data collection, the students were introduced and oriented to the activity zones (zone orientation) while attending their normally scheduled weekly physical education class. This caused minimal intrusion into the students' academic schedules and still provided them time to warm up and participate in the normal physical education activity. Orientation covered proper activity zone use and zone locations and provided time to answer student and faculty questions.

Following preintervention data collection and zone orientation, the same activity zones that the students learned about during their weekly physical education classes were implemented during recess. Students were asked to participate in the associated zone activities,

Table 1
Zone Description and Equipment for School A

Zone	Game	Description	Equipment
1	Functional Movement Obstacle Course	Students use movable obstacles to create a course between the existing jungle gym and playground structure.	Foam rods, connectors, rubber cones of various heights
2	Basketball	A research volunteer facilitates the initial team creation and the students govern the game and keep track of the score.	Colored jerseys, basketballs
3	Walking Track and Balance Corner	Chalk was used to add stretching or calisthenic exercise checkpoints to the existing walking track. The balance corner was attached to the track, and students balance on two dome cones in a large circle while attempting to bound a rubber ball between opponents' legs.	Railroad chalk, rigid dome cones
4	Soccer	A research volunteer facilitates the initial team creation and the students govern the game and keep track of the score.	2 goals, youth soccer ball
5	Kickball	A research volunteer facilitates the initial team creation and the students govern the game and keep track of the score.	4 bases, rubber kickball
6	Castle Ball	A research volunteer facilitates the initial team creation and the students govern the game and keep track of the score. Teams defend their Hula-Hoop castle against the opponents' attack, without crossing the territory line.	6 Hula-Hoops, 10–16 3-in. rubber balls

Table 2
Zone Description and Equipment for School B

Zone	Game	Description	Equipment
1	Basketball	A research volunteer facilitates the initial team creation and the students govern the game and keep track of the score.	Colored jerseys, basketballs
2	Knock-Out Hopscotch-In	Students line up at the free throw line. The first two student shoot the ball at the basket. If the second shooter makes the shot before the first shooter, the first shooter is knocked out and must hopscotch while dribbling to get back in line. When a shot is made or a player is knocked out, the ball is passed to the next person in line and they can being shooting.	3 basketballs
3	Balance Corner and 4-Corner Switch	The balance corner was attached to the track, and students balance on two dome cones in a large circle while attempting to bounce a rubber ball between opponents' legs. In 4-corner switch, students line up at the corner of a square chalked out on the ground. Four students go to the corners of the square and another goes to the middle. The middle student yells "switch" and all five students must find a new corner to stand in. The student who does not get to a new corner quickly enough goes to the end of the line and the new student goes to the middle. Any disputes, use 1 game of rock, paper, scissors to decide a victor.	Railroad chalk, rigid dome cones
4	Imagination Free Play	Students create their own games using their imaginations.	
5	Functional Movement Obstacle Course	Students use movable obstacles to create a course between the existing jungle gym and playground structure	Foam rods, connectors, rubber cones of various heights
6	Drop That Cookie!	"Cookies" are left on the ground in this zone and the first students to pick them up begin the game. Students with a "cookie" are chased by those who did not. If tagged, the student with the "cookie" must drop it and another student can then pick it up. After a 5-second grace period, the new chase begins.	At least 3 mini rubber cones

but had the liberty to change zones at any time during recess. Each zoned activity was clearly indicated on a dry erase board in addition to color-coded signs positioned at the zone boundaries. In zones with concrete or asphalt surfaces, railroad chalk was used for zone marking. When necessary, zone implementation was carried out by the research volunteers and recess supervisory staff while the principal investigator conducted SOPLAY observations.

Students' recess activity was observed and measured via SOPLAY and pedometry simultaneously for 10 days after zoning. Because of the potential for activity zones to improve PA through novelty alone, observations from the first five days of the intervention served as a familiarization period. Data collected during the last 5 days of the intervention period were compared to data from the initial 5 days of baseline observations.

Statistical Analysis

A paired samples *t* test compared pre- and postintervention step counts. Subjects who did not produce step data for at least five days prior to and during the intervention were removed from analysis. The SOPLAY data from each observation day prior to and following zoning were combined, and the percentage of students participating in low or no activity (S, W) versus those categorized as active (V) was calculated. The researchers used McNemar's test to identify significant changes in children observed in low or no activity (S,W) compared to very active (V) children before and after zoning. For the McNemar analysis, the average number of students observed in low and no activity (S,W) were a combined average and coded as 0, and the number of students observed as very active (V) was coded as 1. Data from both schools were analyzed together. Statistical analyses were carried out in IBM SPSS statistics software (Chicago, IL).

Results

Playground Zones

Zones (Z; Table 1 and 2) were analyzed separately by school. At School A, Z1 consistently produced the highest number of children categorized as V, with the lowest number in Z5. At School B, Z6 was the most active and Z2 the least active. The zones that produced the highest number of V children differed for boys and girls at both institutions. At School A, Z1 was the most active for girls and Z2 was

the most active for boys. Z4 and Z6 proved the most active zones at School B for girls and boys, respectively.

Step Counts

Paired samples *t* tests were conducted for students wearing pedometers. Seven students did not record 5 days of traditional playground (TP) and 5 days of zoned playground (ZP) step counts. Therefore, step count data were analyzed for 42 students (21 boys, 21 girls). There was a statistically significant ($p < .05$) increase in steps on ZP (1,676 ± 547 steps) compared to TP (1,502 ± 452; Figure 1).

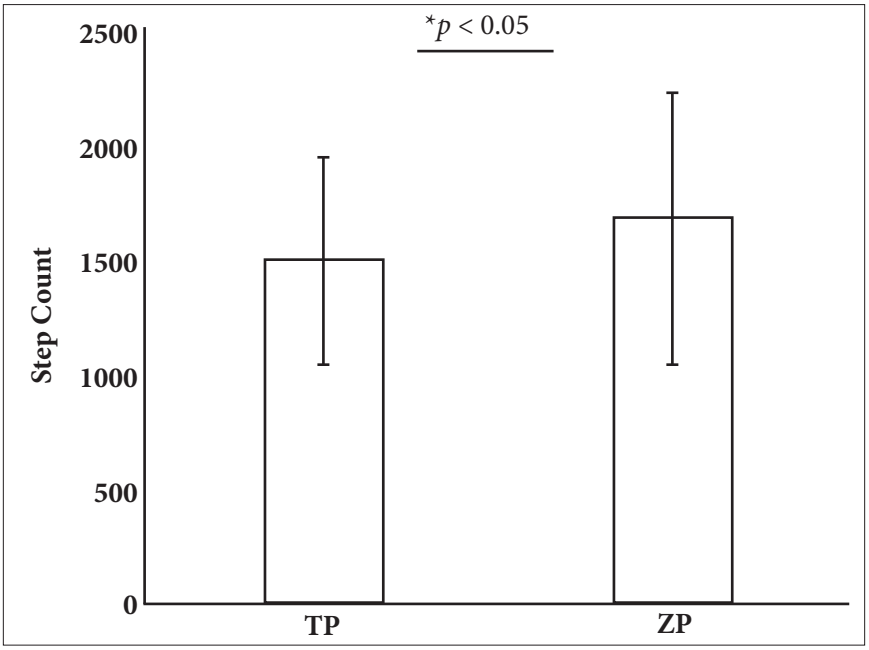

Figure 1. Comparison of step counts between traditional and zoned playgrounds. Significant differences were found between average number of steps achieved on TP (1,502 ± 452) compared to ZP (1,676 ± 547 steps).

Paired samples *t* tests compared TP and ZP differences in step counts for boys and girls separately. Mean step counts for boys and girls increased following zoning. The girls showed a 42-step increase on ZP (1,435 ± 459) versus TP (1,393 ± 451), which was not significant ($p > .05$). The boys displayed a statistically significant ($p < .05$) mean increase of 307 steps on ZP (1,917 ± 531) compared to TP (1,610 ± 436; Figure 2).

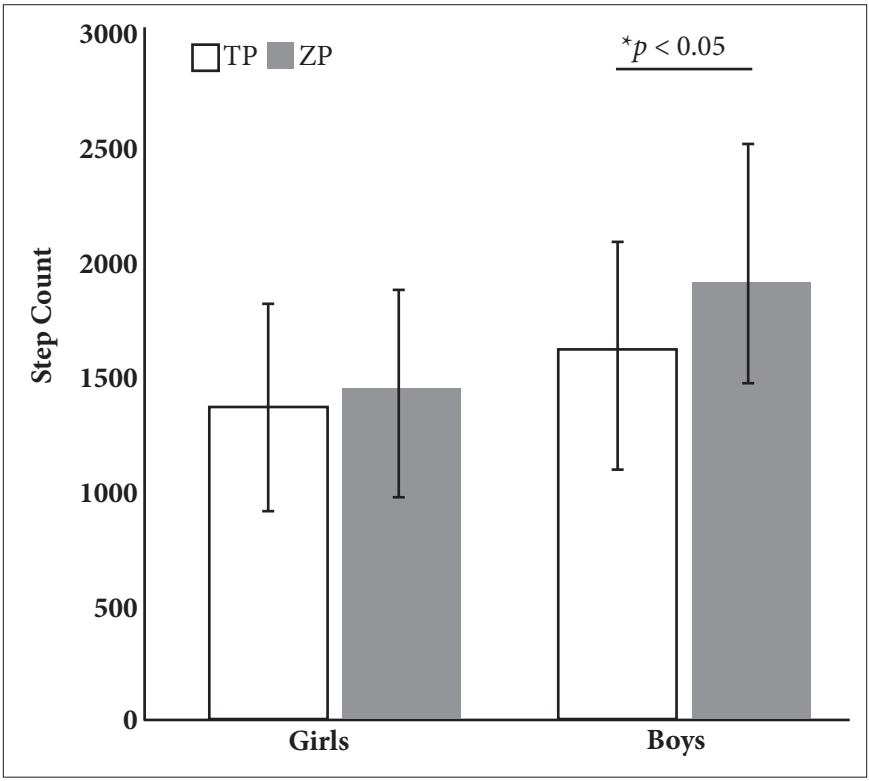

Figure 2. Comparison of average steps accumulated between boys and girls on traditional and zoned playgrounds.

SOPLAY

SOPLAY counts before and after playground zoning were compared. Changes in the percentage of students participating in S or W versus V were analyzed for significance. On TP, 79.4% of observed students participated in S or W and 20.6% participated in V during recess. On ZP, 30.6% of students were observed participating in V, with the number of students observed in S or W decreasing to 69.4%. The 10% increase in very active behavior on ZP was statistically significant ($p = .0001$; Figure 3).

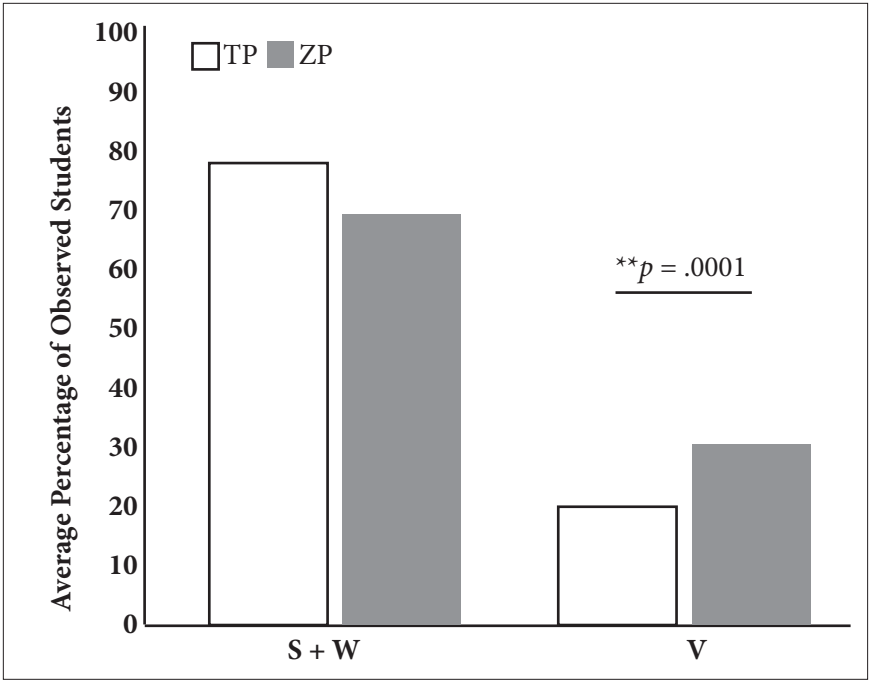

Figure 3. Comparison of SOPLAY counts on traditional versus zoned playgrounds.

When girls were analyzed separately, 83.8% were categorized for S and W on TP with 16.2% observed as V. Girls participating in very active behavior on ZP increased to 27.1%. The 10.9% change in girls' activity during recess was statistically significant (p = .0001). Boys were more active than girls with 75.4% of boys participating in S or W on TP, and 24.6% participated in V. On ZP, the percentage of boys participating in V increased significantly by 9.3% (p = .0001; Figure 4).

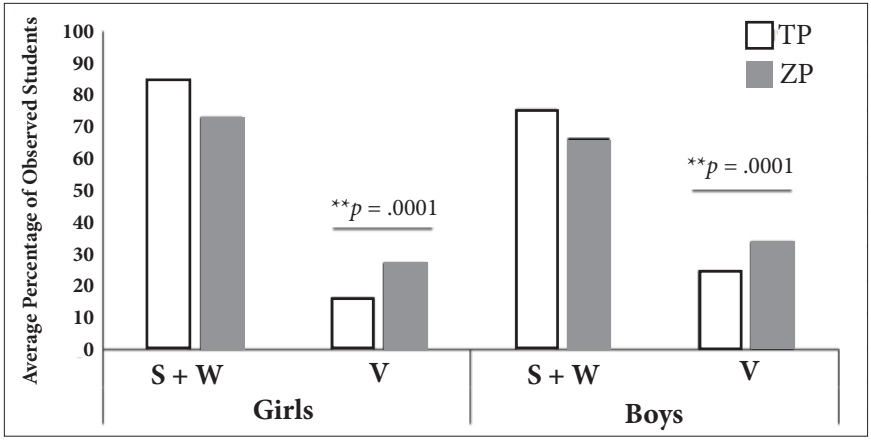

Figure 4. Comparison of SOPLAY counts between girls and boys on traditional and zoned playgrounds.

SOPLAY Reliability

Interobserver reliability estimates were calculated and agreement between observers for all SOPLAY observations were tested. Observer agreement was also tested for boys and girls separately. Kappa coefficients measured agreement between two testers, with a score over .80 indicating a substantial agreement (Shrout, 1998). There was a strong agreement between observers (Kappa .85, $p < .05$). A strong agreement between observers remained when observations for boys and girls were investigated separately (Girls: Kappa .93, $p < .05$; Boys: Kappa .92, $p < .05$).

Discussion

The primary purpose of this study was to investigate changes in PA during recess that may occur after zoning of a traditional playground. A secondary purpose was to determine which zones elicit the greatest levels of activity. A tertiary purpose was to compare an observational measure of PA (SOPLAY instrument) to PA measured via pedometry. Third, fourth, and fifth grade students were selected as the primary population of interest because PA decreases once students reach age 9 (Nader, Bradley, Houts, McRitchie, & O'Brien, 2008; Troiano et al., 2008). The researchers incorporated two schools to achieve adequate power to detect differences. This population is similar but larger than populations in previous recess research using

SOPLAY (Saint-Maurice, Welk, Silva, Siahpush, & Huberty, 2011). Observing playgrounds at two smaller schools versus one large school improved accuracy of data collection while also expanding the generalizability of the findings.

We found that ZP were very effective at increasing activity during recess (Figure 5). Most important, the intervention improved activity without removing freedom of choice from the students, which is vital in developing effective decision-making skills (Maxim, 1997). Past interventions that improved students' moderate to vigorous PA during recess often removed much of the students' ability to choose activities for themselves (Howe et al., 2012). In the youth and activity literature, the lack of student choice is rarely recognized as a limitation or study design flaw. Offering choice and increasing activity during a discretionary period is different. Our design and results clearly show that ZP increased activity while maintaining student choice.

Physical Activity on Zoned Playgrounds

The number and length of recess periods per school day is highly variable between schools. To compare this study to previous research, we extrapolated step counts of third and fourth graders during a single recess period (20 min; Erwin, Beighle, Noland, Worley, & Riggs, 2012; Tran, Clark, & Racette, 2013) to match our 25-min recess.

Following zoning, student activity during recess increased whether assessed via SOPLAY or pedometry for boy and girls. Both tools used to measure PA during recess uncovered trends similar to those in previous studies, with boys being more active than girls on TP and ZP (Ridgers et al., 2011; Ridgers et al., 2006; Sallis, 2000; Stratton et al., 2007). According to our observational measure (SOPLAY), children participating in very active behavior (V) increased on ZP versus TP by 10% (Figure 2). This is similar to the 9.6% increase in vigorous PA assessed by accelerometer following ZP reported by Huberty et al. (2011). The current data indicate that SOPLAY is a valid and reliable tool that researchers can use to assess PA of youth. Our SOPLAY findings are similar to those in previous SOPLAY research (Beets, Huberty, & Beighle, 2013; Saint-Maurice et al., 2011).

Even though boys were still more active than girls on ZP, girls underwent a larger increase in very active behavior (V) during recess

(Figure 4). Given that girls are habitually less active than boys, the fact that their activity increased similarly to that of the boys on ZP is encouraging. Step count data were in agreement with the observed SOPLAY data, showing a significant increase in average steps taken during recess. Students increased their steps by an average of 175 steps/recess on ZP compared to TP, again supporting that ZP is an effective intervention that should be considered as a means to increase youth activity (Figure 2).

Erwin et al. (2012) found that boys averaged 2,113 steps and girls averaged 1,523 steps during TP recess compared to 1,917 and 1,435 steps accumulated during ZP for the boys and girls, respectively, in our study. However, it is important to point out that in the Erwin study, students recorded their own daily step counts. A preferred method is to blind participants to step counts (Brusseau & Kulinna, 2014; Tran et al., 2013). The design flaw could have resulted in significantly elevated step counts. The children likely may have altered behavior to please the researcher or for competitive reasons. Tran et al. (2013) found that boys accumulated 1,601 steps during recess, with girls only achieving 1,220 steps. Boys and girls from the current study exceeded these averages following zoning, but not before. There is a large variability in the amount of activity that youth accumulate on different playgrounds and under different circumstances. Nevertheless, the current data show similar step counts to previous research, indicating validity of the pedometer data.

Zone Activity

Saint-Maurice et al. (2011) used SOPLAY to address a common shortcoming of studies investigating PA. This shortcoming was information about the conditions or settings (i.e., supervision and/or availability of equipment) that may encourage youth to be more or less active at recess. SOPLAY was used in the current study for similar reasons and allowed identification of zones that produced the most activity, measured as the number of children observed being very active (V) in each zone. After identifying which zones were the most active, we found several commonalities among zones. When active girls and boys were added together, the most activity occurred in zones that did not have teams and allowed room for creative strategy. The most active zones at Schools A and B were similar in layout and included a combination of open spaces and obstacles.

Zone activity for boys and girls was then analyzed separately. The playground zones that facilitated the greatest amount of activity differed for boys and girls, regardless of school. Girls at School A were similar to girls at School B in terms of the zones that encouraged the most activity. Although the activity zones were adjusted from one school to the next, girls at both schools preferred similar activities. Z1 and Z4 at Schools A and B involved the girls being the most active while participating in less structured activities in terms of teams and rules, with more freedom to alter the space and adapt their own rules and team dynamics. Both zones also contained one or more permanent play structures to incorporate (i.e., climbing structures, monkey bars, tunnels, slides, and bridges). For boys attending School A, the basketball zone resulted in the most activity. The boys attending School B also had a basketball zone, and it had the second highest observed activity level. However, the most activity for boys at School B was a zone called Drop That Cookie, which is explained in Table 2. Despite boys from Schools A and B being most active in different zones, both zones had a lot of similarities. Both games had competitive aspects and allowed for physical contact. The conclusion might be drawn that boys are most active in zones that allow for more contact/roughhousing with a distinct and well-understood set of rules to minimize arguments or disputes.

These data indicate a clear difference between boys and girls in the zones that facilitate the most activity. A majority of boys were most active in zones with more structured games that allow for traditional teamwork and physical contact, whereas most girls shied away from this type of activity. Girls were most active in zones with less structure and with freedom to adapt and adjust the games they play. It is important for future application of ZP that several activities that meet the description of the aforementioned environments are provided.

Indoor Recess on Zoned Playgrounds

One of the leading problems schools face is how to handle recess when the weather does not permit outdoor activity. It is imperative, not only to subject compliance, but also to general success of the intervention, that zones are implemented consistently. Skipping recess because of inclement weather should not be an option. An indoor recess plan can help youth master the different zones and

improve activity on the playground when students can play outside. Unfortunately, schools in this study did not include indoor recess. Plans for an indoor recess that facilitates activity, rather than limiting it, could greatly affect daily PA levels. With planning and organization, many of the outdoor recess zones can be used indoors on a smaller scale. Future studies should include comparisons of indoor zoning versus outside zoning recess.

Limitations

This study suffers from several limitations. A small shortcoming to this study is that the number of students who wore pedometers was small (n = 42). Being able to collect quantitative data on all students would have strengthened our conclusions. Nevertheless, enough statistical power was present for us to detect differences and evaluate the SOPLAY tool.

A second limitation is in how the SOPLAY was administered. The tool is designed to investigate the intensity of activity within different activity areas. It is not designed to follow a particular student over time. Therefore, it is impossible for us to know if the increased percentage of active children observed during recess on ZP occurred in a linear fashion. In other words, we could not assess if children from the sedentary category (S) were moving into the walking category (W) and those previously observed in walking behavior were moving into the very active category (V). Nor does it address if the change in student activity following ZP was more sporadic. Having pedometers and/or accelerometers on students before and after zoning and using a repeated measures statistical design would have resulted in stronger data.

Additionally, we did not compare disciplinary action before and after zoning. Previous research shows improved behavior and decreases in disciplinary action with more activity (Murray & Ramstetter, 2013). This is true during recess itself and throughout the school day. We theorize that the increased activity with zoning may have resulted in improved student behavior and less disciplinary action needed. Future research should investigate disciplinary issues before and after zoning as an increase in improved behavior could result in an additional advantage to utilizing ZP.

Conclusion

ZP can be used as a simple and effective strategy to reduce sedentary behavior and increase activity during recess. Schools should consider zoning playgrounds and offer zones that cater to boys and girls. They should also develop an indoor recess plan for implementing some or all of the zones during times of inclement weather. Zoning takes effort, communication, and time, but appears to make a difference in youth activity levels. Interventions, both within and outside of school, aimed at improving activity levels and changing behavior will help to quell the obesity epidemic. Future research might examine the effects of playground zoning on academic performance, injuries during recess, and improved behavior.

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PROFESSIONAL DEVELOPMENT

Professional Development Activities and Support Among Physical Education Teachers in the United States

Catherine E. Cardina and Carol DeNysschen

Abstract

Purpose: *This study described professional development (PD) among public school physical education (PE) teachers and compared PE teachers to teachers of other subjects.* **Method:** *Data were collected from a nationally representative sample of public school teachers in the United States. Descriptive statistics were used to describe teachers' support for PD and the types of PD activities in which they participated. Also, types of professional support received among newly hired teachers and their perceptions of professional preparation were described.* **Results:** *PE teachers reported fewer PD activities compared to teachers of other subjects. They were also less likely to receive release time from teaching and to be financially compensated for PD activities. Newly hired PE teachers, compared to other newly hired teachers, reported higher levels of professional support.* **Discussion:** *Based on the results of this study, recommendations are provided concerning support for PD among PE teachers and newly hired PE teachers.*

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The Centers for Disease Control and Prevention (CDC, 2015a) recommends coordinated school health as a strategy for improving students' health and learning in U.S. schools. In 2014, the CDC and ASCD (formerly the Association for Supervision and Curriculum Development), in collaboration with key leaders from the fields of health, public health, education, and school health, expanded the coordinated school health strategy to the Whole School, Whole Community, Whole Child (WSCC) model (CDC, n.d.). This new model contains 10 interrelated components: physical education (PE) and physical activity (PA), nutrition environment and services, health education, health services, counseling, psychological and social services, social and emotional climate, physical environment, employee wellness, and family engagement and community involvement. The WSCC model was adopted after the recognition of the interdependent nature of health and learning. The WSCC model maintains an ecological approach directed at the whole school, and in turn, the school draws its resources and influences from the community, which addresses the needs of the whole child. The CDC and ASCD suggest the WSCC model be used as a framework for improving students' learning and health in schools (CDC, n.d.).

Another initiative that encourages collaboration across communities to promote quality of life, healthy development, and healthy behaviors through all life stages is Healthy People 2020 (Office of Disease Prevention and Health Promotion, n.d.-a). Led by the U.S Department of Health and Human Services, and other key federal agencies, Healthy People 2020 includes a science-based, 10-year interval set of objectives for improving the health of all Americans (Office of Disease Prevention and Health Promotion, n.d.-b).

The WSCC model and Healthy People 2020 provide guidance specific to improving PA levels of youth. For example, the WSCC recommends school PE schedules, curricula, and instruction support and reinforce health and well-being of students by focusing on lifetime fitness knowledge, attitudes, behaviors, and skills that they need to establish and maintain physically active lifestyles throughout their school years and into adulthood (ASCD, n.d.-b). Congruently, Healthy People 2020 has PA goals to improve health, fitness, and quality of life through daily PA, such as PA-3, "increase the proportion of adolescents who meet current Federal physical activity guidelines for aerobic physical activity and for muscle-strengthening

activity"; PA-4, "increase the proportion of the Nation's public and private schools that require daily physical education for all students"; and, PA-5, "increase the proportion of the Nation's public and private schools that require daily physical education for all students" (Office of Disease Prevention and Health Promotion, n.d.-c, Objectives tab).

Healthy People 2020 physical activity goals were based on the Physical Activity Guidelines for Americans (Office of Disease Prevention and Health Promotion, n.d.-b). These science-based guidelines were designed to help Americans (aged 6+ years) maintain or improve their health through regular activity (U.S. Department of Health and Human Services, 2008). PA guidelines for youth include 60 min or more of PA daily. The majority of the 60 min or more per day should be either moderate- or vigorous-intensity aerobic activity 3 days/week; in addition, youth should participate in muscle- and bone-strengthening activity (e.g., push-ups, jumping rope, running) as part of the daily 60 min. According to the CDC, more than 80% of adolescents do not participate in the recommended amount of PA (Office of Disease Prevention and Health Promotion, n.d.-c).

To meet Healthy People 2020 PA goals and to achieve recommendations related to school PE within the WSCC model, the CDC periodically conducts the School Health Policies and Practices Study (SHPPS) to assess school health policies and practices related to coordinated school health and the WSCC model. In 2012, the survey assessed school health policies and practices at state and district levels and in 2014 at school and classroom levels (CDC, 2015b). The SHPPS assessment of PE and PA component of the WSCC model was guided by the Comprehensive School Physical Activity Program (CSPAP), which includes PA before and after school, staff involvement, and family and community engagement (CDC, 2015a). The CSPAP, developed by the CDC, in collaboration with the Society of Health and Physical Educators (SHAPE America), is a comprehensive guide for schools and school districts to develop, implement, and evaluate school PE programs (CDC, 2015a). One of the goals of the CSPAP is "to provide coordination among the CSPAP components to maximize understanding, application, and practice of the knowledge and skills learned in physical education so that all students will be fully physically educated and well equipped for a lifetime of PA" (CDC, 2015a, p. 12). The CSPAP PE Profiles summarizes the state of PA and PE policies and practices of secondary

schools (CDC, 2014). The report notes that PE teachers' qualifications are important for them to deliver quality PE to students. For example, certified PE teachers have been shown to instruct longer lessons, spend more time developing motor and movement skills, impart more knowledge to students, and provide more of the recommended moderate to vigorous PA to students than do teachers with little or no specialized training in PE (CDC, 2011; Davis, Burgeson, Brener, McManus, & Wechsler, 2005).

Given that instructing students in PE requires a specific set of skills and knowledge (CDC, 2014; Institute of Medicine, Food and Nutrition Board, Committee on Physical Activity and Physical Education in the School Environment, 2013), professional development (PD) through continuing education and training is essential for PE teachers to implement quality PE (CDC, 2014). In the SHPPS 2012 report, PD was defined as workshops, conferences, continuing education, graduate courses, or any other kind of in-service for those who teach PE in the school system (CDC, 2013). Specific to PE, the CDC (2014) noted that PD programs should be designed to assist PE teachers in providing instruction directed to the interests and skill level of all students and should focus on concepts of quality PE instruction such as improving teaching methods and incorporating national and state standards into the curriculum.

Because of the importance of ongoing PD among PE teachers to ensure implementation of high quality PE programs, the PE Profiles monitors the status of PD related to PE. Two years prior to the SHPPS 2012 survey, states provided funding for PD or offered PD programs on a variety of PE and physical activities (26 such topics) included in the questionnaire, to those teaching PE. Ninety percent of states provided funding for or offered PD on at least one of the 26 topics, 61% provided funding for or offered PD on at least 13 of the 26 topics, and 2% of states provided funding for or offered PD in all 26 topic areas. More than 70% of districts provided funding or offered PD on administering fitness testing; aligning PE standards to curriculum, instruction, or student assessment; preventing, recognizing, or responding to concussions among students; and preventing injury and providing first aid (CDC, 2013). There were also noted increases between 2000 and 2012 in the percentage of districts that provided funding for PD or offered PD in areas such as engage-

ment of students in moderate to vigorous PA and other critical topics including administering or using fitness tests, helping student develop individualized PA plans, and assessing or evaluating student performance in PE. In general, the SHPPS 2012 reported a significant increase between 2000 and 2012 in the percentage of states that provided funding for PD or offered PD related to PE (CDC, 2013). In addition, results from the SHPPS 2014 indicated that more than half of schools required PE teachers to earn continuing education credits on PE topics or instructional strategies (CDC, 2015b). Overall, these data provide an assessment of funding for PD activities related to PE, the physical activity topics addressed during PD, and requirements related to continuing education in PE.

However, questions remain about the extent to which PE teachers participate in PD, the types of PD activities in which they participate, and the types of instructional support they received. As noted by Napper-Owen, Marston, Van Volkinburg, Afeman, and Brewer (2008), PD is one of the foundational categories of a highly qualified PE teacher, in addition to preservice preparation and designing and delivering a PE program. Therefore, this study sought to assess various elements of the three foundational categories of a highly qualified PE teacher by describing PD among K–12 public school PE teachers in the United States. Research questions included the following:

- What types of PD activities did K–12 public school PE teachers participate in compared to teachers of all other subjects?
- What types of support for PD did K–12 public school PE teachers received compared to teachers of all other subjects?
- What types of PD activities did newly hired K–12 public school PE teachers participate in compared to teachers of all other subjects?
- What were the perceptions of professional preparation in teaching among newly hired K–12 public school PE teachers?
- What percentage of K–12 public school PE teachers reported they were National Board Certified Teachers (NBCTs) or pursuing Board certification?

Finally, this study describes 2011–2012, K–12 public school PE teachers, in general, in terms of gender and race or ethnicity compared to teachers of all other subjects.

Method

Data reported for this study were from the 2011–2012 Schools and Staffing Survey (SASS), a comprehensive national survey conducted by the National Center for Education Statistics (NCES, n.d.). Beginning in the 1980s, the survey has been administered nearly every 3 years to a nationally representative sample of public, private, and charter school personnel, including teachers, administrators, and library media specialists.

Participants

Data used in this study were collected from a representative sample of public school teachers teaching in K–12 buildings during the 2011–2012 school year, in the United States. Teachers were defined as staff members ($N = 37,497$) who teach regularly scheduled classes to students in U.S. public schools. PE teachers were defined as teachers who indicated their main teaching assignment field at their school was PE ($n = 1,764$), and their responses were compared to the responses of teachers of all other subjects ($n = 35,733$). Newly hired teachers were participants who indicated their first year of teaching occurred anytime from the 2008–2009 to the 2010–2011 school year ($n = 8,645$). Responses from newly hired PE teachers ($n = 334$) were compared to responses of newly hired teachers of all other subjects ($n = 8,311$). Human subject approval for this study was provided by the university IRB Office.

Sampling Procedures

The SASS *NCES Handbook of Survey Methods* (Burns, Wang, & Henning, 2014) defines schools as institutions employing one or more teachers serving grades K–12 and where instruction is conducted in a building that is not a private home. School building characteristics were retrieved from the NCES Common Core of Data for the same academic year as the survey and used as the sample frame. Schools from all 50 states were included in the sample frame, whereas overseas and Department of Defense schools were not. Additional public schools from alternative and juvenile justice system schools in California, Pennsylvania, and New York were added for a frame of 90,530 public schools. Of the public schools, 11,000 from 5,798 districts were included in the sample, from which 37,497 teachers of all subjects were surveyed. For this study, the separate charter

school sample was not included. The teacher sample was stratified by experience, which ensured a representative sample of beginning and early career teachers. Early career teachers answered additional questionnaire items related to their induction experiences, beliefs, and attitudes.

A stratified complex design weighting individual sampling units (teachers) was used, which corrected for bias due to deliberate oversampling of certain members of the population. The first stage involved schools as the frame. Teachers in schools selected for the study were subsampled with a complex cluster sampling methodology, which produced a nationally representative sample of public school teachers (NCES, 2014). Weights developed by NCES were applied to the SASS data set, which approximated the population of public school teachers. Because of the great variations in district sizes across the country, NCES employed a multistage stratified sampling design whereby districts in Maryland, Florida, Nevada, and West Virginia were aggregated at the state level for sampling because of the large size of the districts within these states. The final weighted sample of the public school teachers was 3,385,171. This weighted sample was nationally representative of public school teachers and therefore generalizable to the national population of public school teachers in the United States. The weighted unit response rate for public school teachers was 77.7%.

Instrumentation

Data for this study were extracted from specific questions from the Teacher Questionnaire from the SASS 2011–2012 (NCES, 2011). General information and background questions gathered information on teaching assignments, gender, and race or ethnicity. In the Certification section of the questionnaire, teachers indicated if they were NBCTs or working toward Board certification. The Education and Training section of the questionnaire identified newly hired teachers' perceptions of their professional preparation and types of professional support they received. Questions regarding types of and support for PD activities were located in the Professional Development section of the survey.

Data Analysis

The researchers used descriptive statistics to analyze data and answer research questions.

Results

Overall, public school PE teachers in the United States during the 2011–2012 academic year (n = 157,155) were 43.8% female and 56.2% male. Of teachers of other subjects (n = 3,228,017), 77.9% were female and 22.1% were male. The most common race or ethnicity reported among public school PE teachers was non-Hispanic, White (82.0%), followed by non-Hispanic, Black (8.5%); Hispanic, White (6.1%); and non-Hispanic, Asian (1.1%), and for all other teachers, 81.9%, 6.7%, 6.9%, and 1.8%, respectively. Both sample populations had responses that reported other race or ethnic groups, but at less than 1%. Less than half of the PE teachers were female, and over three quarters of teachers of other subjects were female. For PE teachers and teachers of other subjects, approximately 20% reported a race or ethnicity other than non-Hispanic, White.

As Table 1 notes, the most reported types of professional activities during the previous 12 months for PE teachers and teachers of other subjects were attending workshops, conferences, or training sessions; participating in PD related to the subjects they taught; use of computers for instruction; and student discipline and classroom management. However, PE teachers, compared to teachers of other subjects, reported less participation in six of the nine types of PD activities listed in Table 1. For example, they were less likely than other teachers to report having PD specific to or with a concentration on the subjects they taught. In addition, they reported less attendance at workshops, conferences, or training sessions in which they were not presenting; were less likely to attend university courses related to teaching; and were less likely to attend PD related to use of computer for instruction. Furthermore, they reported less participation in PD related to teaching students with disabilities and, notably, almost 10% less participation related to teaching limited-English proficient students or English-language learners. Compared to teachers of other subjects, PE teachers more often presented at workshops, conferences, and training sessions and went on observation visits to other schools. They were also more likely than teachers of other subjects to have had PD that focused on student discipline and classroom management.

Table 1
Professional Development During the Past 12 Months Among K–12 Public School Teachers as a Percentage of the Population (N = 3,385,171)

Survey item	Physical education teachers (*n* = 157,155) Yes %	All other teachers (*n* = 3,228,016) Yes %
Participated in professional activity, such as:		
University course(s) related to teaching	21.0	27.2
Observation visits to other schools	25.0	21.7
Presenter at workshops, conferences, or training sessions	24.1	23.1
Attended workshops, conferences, or training sessions, but not presenter	87.5	92.0
Concentrated on and specific to subject(s) taught	79.3	85.1
Focused on use of computers for instruction	62.2	67.4
Focused on student discipline and classroom management	53.4	42.0
How to teach students with disabilities	34.5	37.6
How to teach limited-English proficient students or English-language learners	18.0	27.2
Received support for professional development, such as:		
Release time from teaching (someone else assigned to teach)	44.5	51.0
Scheduled time in the contract year	79.1	78.5
Stipend for activities outside of work hours	17.7	27.6
Full or partial reimbursement of college tuition	8.6	9.3
Reimbursement for conference or workshop fees	26.0	28.5
Reimbursement for travel and/or daily expenses	18.8	20.8

Table 1 also describes support teachers received for PD activities during the past 12 month. For example, approximately 79% of all teachers reported that they had scheduled time in the contract year for PD activities. Over half (51.0%) of teachers of other subjects reported receiving release time from teaching (i.e., their regular teaching responsibilities were temporarily assigned to someone else). Conversely, less support was provided to physical educators, with only 44.5% reporting release time for PD. Moreover, compared to teachers of other subjects, PE teachers were less likely to report a stipend for PD activities outside of work hours or reimbursement for college tuition, conference or workshop fees, and travel expenses. Table 1 shows that, overall, PE teachers had lower participation rates in six of 10 types of PD, in addition to lower levels of support for PD, with the exception of opportunities that occurred during the contract year.

Higher levels of professional support in seven of eight categories were reported by newly hired PE teachers compared to newly hired teachers of other subjects (see Table 2). Most notably, over 85% of newly hired PE teachers indicated they received regular supportive communication with administrators, principal, or department chair, compared to three quarters of newly hired teachers of other subjects. For all newly hired teachers, over 80% participated in a teacher induction program. Nearly 75% reported that they worked closely with a master or mentor teacher who was assigned by their school or district. Next, the most common professional support was seminars or classes for beginning teachers, followed by a common planning time with teachers in their subject. Only about one quarter of teachers received extra classroom assistance (i.e., teacher aides), and even fewer (about 10%) had a reduced teaching schedule or a number of preparations. Overall, the three main types of professional support for newly hired K–12 public school teachers were participating in teacher induction programs; receiving supportive communication with administrators, principal, or department chair; and working closely with a master or mentor teacher who was assigned by their school or district.

Table 2
Types of Professional Support Received Among Newly Hired K–12 Public School Teachers as a Percentage of the Population (N = 628,447)

Survey item	Physical education teachers (*n* = 22,909) Yes %	All other teachers (*n* = 605,538) Yes %
During your first year of teaching, did you:		
Participate in teacher induction program?	84.5	83.9
Have reduced teaching schedule or number of preparations?	11.5	8.4
Have common planning time with teachers in your subject?	55.0	55.3
Have seminars or classes for beginning teachers?	69.7	64.9
Receive extra classroom assistance (e.g., teacher aides)?	27.4	25.7
Receive regular supportive communication with principal, other administrators, or department chair?	85.4	75.0
Work closely with a master or mentor teacher who was assigned by your school or district?	74.6	74.4

Newly hired PE teachers also reported their perceptions of how well prepared they were to perform specific professional skills (see Table 3). Study participants reported that they were very well prepared to teach their subject matter, and about half (49.5%) felt very well prepared to meet state content standards. They felt less prepared to use a variety of instructional methods and differentiate instruction. Newly hired physical educators felt least prepared to handle a range of classroom management and discipline situations, use computers for instruction, assess students, and use data from student assessment to enhance data-driven decision making and inform instruction.

Table 3
Perceptions of Professional Preparation Among Newly Hired K–12 Public School Physical Education Teachers as a Percentage of the Population (n = 22,909)

	Prepared				
Survey item	Not at all %	Some-what %	Well %	Very well %	Total %
In your first year of teaching, how prepared were you to:					
Handle a range of classroom management or discipline situations?	1.1	25.7	47.9	25.3	100.0
Use a variety of instructional methods?	1.5	15.8	45.9	36.7	100.0
Teach your subject matter?	0.7	5.1	30.2	64.0	100.0
Use computers in classroom instruction?	8.9	28.1	38.0	25.0	100.0
Assess students?	1.9	19.0	46.0	33.1	100.0
Differentiate instruction in the classroom?	3.5	14.7	49.7	32.1	100.0
Use data from student assess-ment to inform instruction?	7.0	26.4	42.0	24.6	100.0
Meet state content standards?	1.2	11.8	37.4	49.5	100.0

Concerning NBCTs among participants, 22.9% (n = 35,919) of public school PE teachers reported having Board certification. Among PE teachers who reported being NBCTs, 71.4% (n = 25,638) earned Board certification in PE; 12.3% (n = 4,423) in elementary grades, general; and 4.8% (n = 1,742) in health education. Of the remaining PE teachers that were not certified, 2.4% (n = 2,881) reported that they were in the process of earning certification. Among teachers of other subjects, 16.3% (n = 525,215) reported they were NBCTs and 3.4% (n = 4,423) reported they were pursuing certification. Overall, nearly one quarter of PE teachers were NBCTs, which was more than teachers of other subjects.

Discussion

As noted by Napper-Owen et al. (2008), a highly qualified PE teacher includes three foundational categories: PD, preservice/professional preparation, and designing and delivering PE programs. With regard to PD, newly hired PE teachers reported higher rates of professional support compared to newly hired teachers of other subjects; however, the results from all K–12 PE teachers regarding support for PD during the past 12 months were not as favorable. PE teachers more often reported that their PD opportunities occurred during scheduled time in the contract year than did teachers of other subjects. They were also less likely than teachers of other subjects to receive release time from teaching for PD and to be financially compensated for their PD activities. For example, they were less likely to receive a stipend for activities outside of work hours and to be reimbursed for conferences or workshops, including related travel and daily expenses. Furthermore, they were less likely to report receiving full or partial reimbursement for college tuition.

These data may provide some insight into why physical educators less often reported rates of participation in professional activities such as colleges courses related to teaching, PE-specific activities, and attending workshops, conferences, or training sessions in which they were not presenting than did teachers of other subjects. Lack of PD support for PE teachers may have been due to the previous emphasis on PD under the No Child Left Behind (NCLB) Act, which was for core subjects, thus excluding PE. As noted by ASCD (2015), the Every Student Succeeds Act (ESSA) eliminates the NCLB definition of core subjects and expands access to PD to include teachers of all subjects.

Although support for PD activities was lower for PE teachers compared to teachers of other subjects, PE teachers were more likely to be NBCTs, which provides evidence of their professional commitment to advancing student learning and achievement. As noted by Napper-Owen et al. (2008), PE teachers can enhance their PD by achieving recognition as an NBCT.

As the results of this study indicate, newly hired PE teachers did not feel as well prepared to use computers in the classroom, use data from student assessment to enhance data-driven decision making and inform instruction, and handle classroom management or dis-

cipline situations. These areas may be emphasized for future PD in schools, as data from this study suggest that during the 12 months prior to data collection, just over half of PE teachers attended PD activities regarding classroom management or discipline situations. Moreover, almost 40% of PE teachers did not have professional activities that focused on computers for instruction. PD that enhances PE teachers' knowledge and application of technology may also improve their ability to collect and analyze assessment data to inform and affect instruction. As recommended by the Whole Child Initiative, which supports implementation of the WSCC model, teachers should be able to use a range of diagnostic, formative, and summative assessments to monitor student progress, provide timely feedback, and adjust teaching–learning activities to maximize student progress (ASCD, n.d.-b; CDC, 2014).

In addition, findings from this study provide insight about newly hired teachers' perceptions of their preservice/professional preparation related to some of the attributes described in the National Association for Sport and Physical Education (NASPE, 2007) position paper concerning what constitutes a highly qualified teacher and the National Initial Physical Education Teacher Education (NIPETE) Standards (NASPE, 2008). For example, PE teacher education programs should provide teacher candidates (also referred to as preservice teachers) with substantial pedagogical and content knowledge. With regard to substantial content knowledge, findings from this study show that over 90% of newly hired PE teachers felt they were well or very well prepared to teach their subject matter, and over 85% indicated they were well or very well prepared to meet state content standards. Results related to substantial pedagogical knowledge showed areas in which newly hired PE teachers felt more prepared. Over 80% of participants felt well or very well prepared to differentiate instruction and use a variety of instructional methods. Although most newly hired PE teachers were positive about their level of preparation related to assessing students, about 20% indicated they were only somewhat prepared. Moreover, one third indicated they were somewhat or not at all prepared to use data from student assessment to inform instruction. As noted by NASPE (2007), assessment is an integral component of the teaching–learning process, provides valuable information about student achievement,

and can positively affect curricular changes. In addition, NIPETE Standard 5: Impact on Student Learning emphasizes the need for educators to use assessments and reflection to foster student learning and inform instructional decisions (NASPE, 2008). Moreover, the Whole Child Initiative recommends schools integrate health and well-being into their PD, curriculum, and assessment (ASCD, n.d.-b). Findings from this study suggest that schools need to continue to emphasize professional preparation and continuing education related to assessment among PE teachers.

Of all questions concerning professional preparation posed to newly hired PE teachers in the 2011–2012 SASS, use of computers for instruction was the area for which they felt least prepared. Their responses provide insight into NIPETE Standard 3: Planning and Implementation; specifically, Standard 3.7 states that teacher candidates "demonstrate knowledge of current technology" and "require students to appropriately use technology to meet lesson objectives" (NASPE, 2008). Of newly hired PE teachers, 37.0% indicated they were somewhat or not at all prepared to use computers in classroom instruction. These data suggest that further PD is needed for PE teachers to meet target behaviors noted in Standard 3.7, such as having mastery of current technologies to enhance student learning. Examples of current technology include pedometers, fitness trackers, and video that teachers can use to measure students' activity levels, design and adjust individualized fitness plans, and motivate students to participate in daily activity. In addition, it is suggested that teachers be provided with PD for using assessments, such as Fitnessgram, to create student and parent reports. In 2012, the President's Council on Fitness, Sports, and Nutrition released the Presidential Youth Fitness Program that includes assessment, PD, and awards recognition. As noted in the 2012 SHPPS report, support to implement the Presidential Youth Fitness Program may include PD on how teachers can integrate fitness education into the PE curriculum, use Fitnessgram test batteries, assess student fitness, generate student and parent reports, and provide recognition and awards (CDC, 2013). Use of current technology provides PE teachers with the ability to meet the PA needs of each student and therefore should be a priority for school districts when considering PD activities.

Finally, among newly hired PE teachers, one quarter felt somewhat prepared to handle a range of classroom management or discipline situations. As noted by the National Education Association, classroom management is an ongoing concern for teachers (Zauber, 2003). The Whole Child Initiative recommends staff have the ability to establish and maintain classroom behavior expectations and rules and establish routines that teach students to manage their behavior and help students to improve problem behavior (ASCD, n.d.-b). Data from this study suggest PD related to classroom management and discipline situations would benefit newly hired PE teachers.

In nearly every category, newly hired PE teachers more often indicated receiving professional support than did teachers of other subjects (see Table 2). Notably, they were 10% more likely to report regular supportive communication with their principal, other administrators, or department chair. As noted by Moir (2009), principals and mentors of newly hired teachers create a culture where teacher learning is supported, which benefits student learning and achievement.

Regarding the final research question, data from this study concur with the U.S. Department of Education (2016), which indicated that nearly one fifth (18%) of teachers in the United States are individuals of color. The U.S. Department of Education notes that teachers of color can be positive role models for public elementary and secondary school students, of which nearly half are individuals of color. Benefits of greater diversity in the teacher workforce include reversing negative stereotypes and preparing students to live and work in a multiracial society. The U.S. Department of Education emphasizes the need for stakeholders such as postsecondary institutions, K–12 schools and districts, and others to do more to support recruitment and professional preparation of teachers of color so that students in U.S. public schools can experience the benefits of a diverse teaching force.

Limitations

Subjects self-reported the data and missing responses were imputed. To compensate for individual item nonresponse bias, NCES used a multistage imputation process to derive values that would have a high likelihood of matching the probable response pattern. Item nonresponse rates between PE teachers and the rest of the

population were similar on the reported items at between 1% and 1.5% (Goldring, Taie, Rizzo, Colby, & Fraser, 2013).

When referring to teaching skills, the researchers used the term *classrooms*. They assumed that PE teachers would consider their teaching spaces as their classrooms.

Implications for Physical Education Teachers

The WSCC model seeks to strengthen the link between learning and health using a collaborative approach among 10 school health components (ASCD, n.d.-a). This study provided insights with regard to the PE and PA component of the WSCC model, which encourages youth to be physically active throughout the day. Specifically, this study assessed PD activities among PE teachers who have the responsibility of providing students with the knowledge and skills to maintain lifelong PA. One indicator of the Whole Child Initiative is that school staff are well qualified (ASCD, n.d.-a). Napper-Owen et al. (2008) listed the three general categories of highly qualified PE teachers as PD, preservice/professional preparation, and designing and delivering PE programs. This study provided information related to various elements within these three categories as reported by PE teachers in the United States. Based on results from this study and the corresponding discussion, suggestions for supporting PE and PA within the WSCC model include

- providing PE teachers with opportunities and financial support for PD that is similar to PD support offered to teachers of other subjects;
- encouraging and financially supporting PE teachers who work toward National Board Certification as a means of enhancing their PD;
- designing PD opportunities to meet the specific needs of PE teachers, such as the use of technology to collect and analyze student assessment data to inform and affect instruction and student learning; and
- supporting recruitment and professional preparation of PE teacher candidates from diverse populations so that all students may benefit from a culturally diverse population of teachers.

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YOU AND THE LAW

Coaches Beware of Participating With Players in Practice

Tonya L. Sawyer

Zachary B. Elias v. Kenneth Davis and Sterling Edwards; Ct. App. Mo., West. Dist. Div. Four; 2017 Mo. App. LEXIS 758; 8/8/17

A Missouri court of appeals reversed a trial court and restored a plaintiff's claim that a head football coach and an assistant coach were liable for assault and battery when the assistant coach donned football pads and participated in a practice in which he injured the plaintiff. In the same ruling, however, the court affirmed the finding that dismissed the claim of negligence against the two defendants.

Facts of the Case

The incident in question involved Zachary B. Elias (plaintiff), who on October 19, 2010, was a 16-year-old high school student at Winnetonka High School in the North Kansas City School District and played varsity football for the school. Kenneth Edwards (defendant) was the head coach, and Sterling Davis (defendant) was a position coach. On that day, coaches Edwards and Davis decided to wear a full football uniform with helmet and padding to engage in full-contact scrimmage with the teenaged members of the team. Davis had never scrimmaged with the team in full football pads and helmet before that day. On one of the scrimmage plays, Elias was positioned as a middle linebacker, and Davis was positioned as a running back. During the play, Davis received the handoff from the quarterback and ran through the defensive line and into the zone

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where Elias was the next line of defense to attempt to tackle Davis. In Elias's attempt to tackle Davis and the ensuing bodily collision between adult and child, Elias's ankle was broken.

Complaint

Elias brought negligence and assault and battery claims against Edwards and Davis. The coaches filed a motion for summary judgment. They argued that Elias's negligence claim was barred for two separate reasons—official immunity and assumption of risk—and that his assault and battery claim was barred because Elias consented to the contact with Davis. The trial court granted summary judgment for Edwards and Davis on Elias's claims. Elias appealed.

Court's Analysis of the Case

Addressing the negligence claim first, and the defendants' argument that they are shielded by official immunity, the court noted that the doctrine "is intended to provide protection for individual government actors who, despite limited resources and imperfect information, must exercise judgment in the performance of their duties" (Southers v. City of Farmington, 263 S.W.3d 603, 611). "Its goal is also to permit public employees to make judgments affecting public safety and welfare without concerns about possible personal liability" (Southers v. City of Farmington, 263 S.W.3d 603, 611). "Whether an act can be characterized as discretionary depends on the degree of reason and judgment required" (Southers, 263 S.W.3d at 610).

In their motion for summary judgment, Edwards and Davis argued that official immunity barred Elias's negligence claim because they were performing a discretionary act in conducting the football practice. Instead of producing some form of evidence to the trial court and establishing that the conduct of the football coaches was in direct contradiction to a school district rule, a statute, a regulation, a departmental policy, or even a direct order from a superior at Winnetonka High School, Elias argued that official immunity should not apply in this case, because the coaches were no longer acting within their employment capacity when Davis suited up and scrimmaged with the team, according to the court.

The court deemed this argument was "misplaced."

"Here, it simply cannot be said that Davis's physical participation in the scrimmage during practice was outside the course of

his official duties as a football coach, and Davis's argument ignores case precedent on the topic of official immunity," wrote the court. "A scrimmage is a common tool used by a coach for the team to perform together on the field in simulated game situations and to develop game strategy. Under the limited facts in the summary judgment record, no evidence suggested that either coach was acting with any motive other than to teach and to prepare the football team during the football practice when Davis participated in the scrimmage."

The court continued, "Though it may indeed be a good idea for the school district to have a rule dictating the method and manner in which an adult high school football coach may physically participate with teenaged players in a high school football practice, the record before us does not contain such a rule. Though it may indeed be a good idea for the high school principal or athletic director to have a departmental rule or to have provided direct guidance to school coaches about the method and manner in which an adult high school football coach may physically participate with teenaged players in a high school football practice, the record before us does not contain such a departmental policy or direct advice from these football coaches' superiors at Winnetonka High School. Though it may indeed have been a good idea for the Missouri State High School Athletics Association (MSHSAA) to have a regulation relating to authorized physical participation of a high school football coach with the players in a practice environment at MSHSAA institutions, the record before us does not reference such a MSHSAA regulation."

Court's Ruling

The court continued, "Consequently, we are left with a record in which Davis's scrimmaging with the team must be evaluated as part of the coaches' decision on how to conduct football practice that day. A coach's duty to conduct and supervise a football practice requires the exercise of discretion rather than the performance of routine tasks. See Woods, 471 S.W.3d at 393, 395 (determining how to conduct a wrestling practice is left to the discretion of the coach). It requires the coach to use his judgment. Though the wisdom of the judgment exercised by these coaches may be reasonably debatable, the record before us does not demonstrate a rule, regulation, policy, or direct order of a superior that was violated in exercising that judgment. Thus, Edwards and Davis were performing a discretion-

ary act when they supervised and conducted the football practice in the manner in which they did in the practice in question. Their exercise of discretion was, therefore, protected by the doctrine official immunity as it relates to Elias's negligence claim. Accordingly, the trial court did not err in entering summary judgment in favor of them on Elias's negligence claim, and Elias's claims on appeal relating to the negligence claim are denied."

Turning to the appeal on the assault and battery argument, Elias argued that he neither consented nor assumed the risk of injury. The appeals court agreed with the plaintiff. "By participating in high school football, Elias voluntarily consented to the risks," wrote the court. "Those risks included physical contact and collisions with other players. The limited facts presented in the summary judgment record, however, go beyond the circumstances of physical contact in the course of playing organized high school football. Davis was an adult in full pads and helmet scrimmaging with teenaged members of the high school football team, which he had never done before that day. The record is devoid of any evidence of Davis's skill level or football experience. And as a coach, he was in a position of authority, which could have affected how Elias reacted before or during the play. For example, where an adult football coach barks a command to the teenagers on his team that they will participate in trying to tackle the adult, Coach Davis, it may be reasonably debatable whether a teenaged child such as Elias had 'consented' to such activity. It cannot be said, therefore, that the physical contact with his coach was a reasonably foreseeable consequence of participating in high school football. Reasonable persons could disagree on whether sixteen-year-old Elias voluntarily consented to the collision with Davis. At the very least, whether Elias consented to, or assumed the risk of, the contact with Davis is a proper determination for the jury."

Risk Management Implications

This is a perfect example of "mismatching." The adult football coaches who have experience and skill well beyond the 16-year-old student athlete should have never been allowed to participate against their high school football players. The student athletes did not assume a risk of playing against more experienced adults. They participated because the coach (an authority figure) said they would participate.

The athletic director and school district should have had established the following to avoid such incidents:

- The school district should have a rule dictating the method and manner in which an adult high school coach may physically participate with teenaged players in a high school practice.
- The high school athletic director should have a departmental rule against coaches participating with players during practice and should provide direct guidance to school coaches about the method and manner in which an adult high school coach may physically participate with teenaged players in a high school practice.
- The Missouri State High School Athletics Association (MSHSAA) should have a regulation relating to authorized physical participation of a high school coach with the players in a practice environment at MSHSAA institutions.

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The Physical Educator

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