Journal of Physical Education and Sport ® (JPES), 15(4), Art 120, pp. 788 - 792, 2015
online ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 - 8051 © JPES

Original Article

Mixing or separating students by sex during PE classes? Evidence from 3-a-side soccer games

PEREIRA, A.[1,2]; COSTA, A.M.[2,3,4]; JOÃO, P.V.[5,2]; ESPADA, M. [1,6], DUARTE, R[6]
[1] Polytechnic Institute of Setubal, PORTUGAL
[2] Research Centre for Sport, Health and Human Development, Vila Real, PORTUGAL
[3] Department of Sport Sciences, University of Beira Interior, Covilhã, PORTUGAL
[4] CICS-UBI, Health Sciences Research Center, PORTUGAL
[5] University of Trás-os-Montes and Alto Douro, PORTUGAL
[6] CIPER, Faculty of Human Motricity, Spertlab, University of Lisboa, PORTUGAL

Published online: December 26, 2015
(Accepted for publication November 23, 2015)
DOI:10.7752/jpes.2015.04120

Abstract:
The aim of this study was to examine the influence of mixing and separating students by sex in the game performance, as heart rate (HR) demands and rate of perceived exertion (RPE) during 3-a-side small-sided soccer games (SSGs) performed in the context of Physical Education (PE) classes. Twelve students (6 male of 15.33±0.8 years; 1.77±0.10 m; 67.0±4.2 Kg; 21.50±2.5 Kg.m², and; 6 female of 15.00±0.0 years; 1.61±0.01 m; 53.8±9.1 Kg; 19.9±2.3 Kg.m2) performed the SSGs in two conditions: i) separated by sex and ii) mixed-sex. From single-sex to coeducation conditions results showed significant increases in female RPE and HR (14 to 16.1 and 142 to 163, respectively), but a decrease in the number of wrong passes, goals and shooting accuracy ($p < 0.05$: 80.5 to 15.2; 3.8 to 1.9 and 1.0 to 0.4, respectively). In the male group, only a single significant increase occurred in the total number of passes between the corresponding two conditions ($p = 0.023$: 12.5 to 14.1). When comparing the two gender groups in the mixed condition, we registered significantly higher values of the total number of passes and number of wrong passes in males than in females (74%), while the RPE was higher in females ($p < 0.05$). On the contrary, no significant differences between groups were observed in the separated conditions. These findings suggest a trend toward an increase in the perceived exercise intensity, not completely corroborated by HR data, with less technical proficiency for female students, mainly when playing against their male counterparts. PE teachers should be aware that mixing gender during foot-ball related activities may have a negative impact on female performance, which may impact their motivation and skill acquisition.
Key words: - Physical education, coeducation, perceived exertion, technical proficiency, heart rate, foot-ball.

Introduction

In the context of physical education (PE) classes some learning models derived from empirical research have been suggesting the use of a game-based learning approach (Chow, et al., 2007). This approach may be particularly effective for teaching team games (Werner, Thorpe & Bunker, 1996; Chow, et al., 2009) once the adapted and modified playing activities ensure the intrinsic nature of the competitive and cooperative interactions among team players (Gréhaigne & Godbout, 1995). Empirical research has shown that a game-based learning approach may be effective to improve students' tactical knowledge (Rink, French, & Tjeerdsma, 1996), satisfaction and motivation (Lawton, 1989; Griffin, Oslin, & Mitchell, 1995). Moreover, from the physiological point of view, some recent studies revealed that the use of small-sided soccer games SSGs may constitute an adequate physiological stimulus preventing from children unhealthy lifestyles (Krustrup, Dvorak, Junge & Bangsbo, 2010). Significant improvements in intermittent exercise performance, coordination and maximum oxygen uptake of children and teenagers were observed during SSGs practice (Randers et al., 2010). Worthy of note, long-term studies of children and youngsters using small-sided football games at different ages, with proper control groups, revealed evidence of its effectiveness in the early treatment of obesity and related co-morbidities in childhood (Krustrup, et al., 2010a). With obese children, regular practice of small-sided football games is, at least, as effective in improving the physical capacity, health-related fitness parameters and self-esteem as a standard resistance and strength training program (Krustrup et al., 2010b).

This scientific evidence emphasizes the role that a game-based approach must have hypothetically in the context of school. Nevertheless, a controversial issue that may influence the effectiveness of a game-based learning approach in the context of physical education is the long debate between coeducation versus single-sex class composition (McKenzie, Prochaska, Sallis, & LaMaster, 2004). Arnett and Lutz (2003) showed that during game-based lessons female students spent enough time into moderate to vigorous physical activity to elicit cardiovascular fitness gains. The idea that female students have less ability to sport compared to boys is

Corresponding Author PEREIRA, A, E-mail: ana.pereira@ese.ips.pt

incomplete and need clear evidence to implement new strategies in the PE context. For instance, Pritchard, McCollum, Sundal and Colquit (2014) showed recently that game performance for males and females in a coeducational PE class was similar for males and females in a single gender class using three-versus-three basketball games. Despite this data, there is some literature indicating that sport and physical activity may impact differently on girls' well-being (Pipher, 1994) and self-esteem (Jaffee & Manzer, 1992). Indeed, females tend to perceive their learning experiences and involvement in soccer camps in a different way than their males' counterparts (Jones, 2005). As such, class gender composition may be an important factor influencing physical education learning, especially in secondary school where males and females with diverse anatomical and biological capacities, physical skills and interests come into close physical contact when sharing the same PE classes (Hannon & Williams, 2008; Shimon, 2005). Thus, the purpose of this study was to examine the influence of coeducation versus single-sex physical education class composition on game performance, physiological and perceptual demands during 3-a-side soccer games. We hypothesized that males would register higher game performance values (Pritchard et al., 2014), while females probably would decrease their intensity levels when playing apart from their male counterparts (McKenzie et al., 2004).

Material & methods

Participants

Twelve PE students were recruited and divided by gender to participate in this study: male group (MG, n=6; 15.33±0.8 years; 1.77±0.10 m; 67.0±4.2 Kg; 21.50±2.5 Kg.m²); female group (FG, n=6; 15.00±0.0 years; 1.61±0.01 m; 53.8±9.1 Kg; 19.9±2.3 Kg.m2). An informed consent, approved by the local university, was obtained from each participant and parent assuring their voluntary participation and about the protocol of the study. Further, the high school director was informed about the procedures and goals of the study and agreed with its implementation.

Measeure & Procedure/Test protocol/Skill test trial Instruments

Each group of students performed twice the 3-a-side soccer games apart from routinely scheduled physical education classes. At first, students performed two games under the mixed-gender condition. Five days later, each group performed one game in a gender separated condition. Every SSGs was performed with the supervision of the PE teacher, who encouraged his students using standardized indications previously established (e.g. ''lose your marker'', ''find space'', ''press'', ''get back in quickly''). The experiment was conducted in an indoor facility to avoid influence of weather changes. The 3-a-side soccer games lasted for 8 minutes each, with a pitch size of 20 x 20 m (Duarte et al., 2009). Ten foot-balls were positioned around the pitch allowing players to minimize stoppages in play. Each game was performed after a 20-min warm-up, which consisted of low-intensity running, striding, stretching and familiarization with the foot-balls. All the experiment was videotaped using two digital cameras covering the entire field, which allowed the subsequent notational analysis.

Game Performance Evaluation

Simple and composite game performance indicators were selected from literature (Hughes & Bartlett, 2002; Duarte et al., 2009) in order to analyze students' performance effectiveness in the experimental conditions. The performance indicators were the total number of passes, number of right passes, number of wrong passes, passing accuracy (%), number of shoots, number of goals and shooting accuracy (%). The test-retest reliability was assessed using the intra-class correlation coefficient (ICC), ranging between 0.89 and 0.92 for all measures.

Heart rate and ratings of perceived exertion

The heart rate (HR) was used as a noninvasive indicator of cardiac autonomic modulation. Heart rate (bpm) was registered every 5 seconds during the entire SSGs using short-range HR monitors (Vantage NV, S710, and Xtrainer models, Polar Electro, Kempele, Finland). Immediately after each game, all players were asked to state their RPE relative to the specific game they performed using a printout of the original 20-points Borg's scale (Borg, 1998). All students were previously familiarized with this scale, following the standardized instructions of the instrument.

Statistical analysis

Heart rate and ratings of perceived exertion

The heart rate (HR) was used as a noninvasive indicator of cardiac autonomic modulation. Heart rate (bpm) was registered every 5 seconds during the entire SSGs using short-range HR monitors (Vantage NV, S710, and Xtrainer models, Polar Electro, Kempele, Finland). Immediately after each game, all players were asked to state their RPE relative to the specific game they performed using a printout of the original 20-points Borg's scale (Borg, 1998). All students were previously familiarized with this scale, following the standardized instructions of the instrument.

Results

During the mixed-game, the female group showed a significant increase in HR and RPE compared to the separated condition (142 to 163 bpm and 14 to 16 in Borg's scale, respectively), but experienced a decrease in the number of goals and its corresponding shooting accuracy (between 60 to 80%), as well as in the total number of passes and number of wrong passes (9 to 50%). On the other hand, the male group only registered a significant increase (12.8%), in the total number of passes from the separated to mixed condition (12.5 to 14.1

respectively). When comparing the two groups, no significant differences were observed in the separated condition. Significant differences were observed only in the mixed-gender condition (male vs. female) with males showing higher values in the total number of passes (p=0.036: 14.1 to 8.1, respectively) and number of wrong passes (p=0.014: 4 to 2, respectively) comparatively to females. On the contrary, the RPE and HR was significantly higher in females (6.7 to 9.5%, respectively) compared to males (p=0.027).

Table 1. Simple and composite game performance indicators, heart rate and perceptual responses to 3-a-side small-sided soccer games according to the group and condition (separated: male vs. male and female vs. female; mixed-gender: male x female).

		Separated Condition (S)	**Mixed Condition (M)**	
Variables	**Group**	M±SD	M±SD	Within group Sig. (S) vs. (M)
Total Number of Passes (n)	Female	9.8±2.9	8.1±2.7	**0.037***
	Male	12.5±4.6	14.1±4.9	**0.023***
Right Passes (n)	Female	5.7±2.8	6.0±2.7	0.750
	Male	9.3±4.1	9.5±5.1	0.833
Wrong Passes (n)	Female	3.8±2.06	1.9±0.6	**0.024***
	Male	2.9±0.4	4.1±1.6	0.104
Passing Accuracy (%)	Female	57.8±18.1	70.5±19.4	0.093
	Male	72.5±11.5	65.9±16.1	0.463
Number of Shoots (n)	Female	2.0±1.8	1.9±1.3	1.000
	Male	2.4±1.7	2.5±0.8	0.715
Goals (n)	Female	1.0±0.7	0.4±0.6	**0.020**
	Male	1.4±0.8	1.1±0.8	0.684
Shooting Accuracy (%)	Female	80.5±30.5	15.2±27.0	**0.044***
	Male	66.6±25.8	50.0±41.8	0.463
RPE-Borg's scale (6-20)	Female	14.0±0.8	16.1±0.8	**0.027***
	Male	15.2±1.2	14.7±1.1	0.399
HR (bpm)	Female	142.0±13.6	163.0±5.6	**0.027***
	Male	154.0±11.0	152.3±12.7	0.750

***** denotes significant differences between performance conditions.

Dicussion

We investigated the influence of mixing and separating PE students by gender in the game performance, HR and RPE during 3-a-side small-sided soccer games. Our data suggested that changing the composition of the groups during PE classes may have an impact in performance, at least during the analyzed 3-a-side soccer games. These findings contradict previous results of Pritchard et al. (2014) who found similar game performance for males and females between coeducational and single gender classes. On the other hand, our data agrees with Pritchard and colleagues (2014) by showing that performing against their male counterparts implies a decrease in the number of involvements with the ball. The decrease in the number of involvements was revealed by lower number of passes, goals and shooting accuracy of females compared to males. When comparing the two gender groups in the mixed condition, we registered significantly higher values of the total number of passes and number of wrong passes in males than in females (74%). Different class organization might contribute to poor or increased learning and development of technical skills in team sports (Sallis et al., 2012; McKenzie & Lounsbery, 2009; Lee et al., 2007). Besides, the present data, after compared SSGs in the two conditions, showed a significant HR and RPE increase in females in the mixed game compared to the separated condition (142 to 163 bpm and 14 to 16 in Borg's scale, respectively). This seems to contribute to one important PE purpose – improve student's physical fitness particularly in girls, who seem to practice more soccer (each skill), with more success and at a higher game intensity (US Department of Health and Human Services, 2008). Although, physical activities guidelines recommend at least 60 minutes of moderate to vigorous physical activity daily for young population and usually it decreases in high school (McKenzie, 2009). Nevertheless, during the mixed-game, the female group experienced a decrease in the number of goals and its corresponding shooting accuracy (between 60 to 80%), as well as in the total number of passes and number of wrong passes (9 to 50%). However, in the male group, it only was observed a single significant decrease in the total number of passes between the two game conditions (17.3%). The reason for this may be the demotivation when they are playing with girls (Smith et al., 2012). It seems that the higher exercise intensity that we observed in female group may overdrawn the stability of the game in mixed conditions (NICHD, 2003) and this might be due to the students having a reduced amount of possession of the ball analyzed by the total number of passes. This is a novel finding, because the results of the present study complement the suggestion developed by Balsom (1999) when differences between genders are analyzed. Interestingly, the phenomenon surrounded by SSGs may contribute to girls' self-efficacy beliefs and contribute to an equal positioning in the game (Furrer et al., 2010). In the present study, girls seems to run more with/without ball and motivation could be the reason, causing an increase in HR and RPE compared to boys, taken into account that in mixed-gender game, male group substantially decrease pacing accuracy (-9%) compared to girls (22%). Additionally, female team may have been encouraged to play and run more in order to create passing opportunities.

Intensity in the SSGs may depend upon the possession ball reflecting the efficiency in pacing accuracy in female group in mixed-gender game but it seems not to change the number of goals. Further, according to our results, the increase in HR frequency by 14.3% correspond to a 16 point in Borg scale in mixed-game, reveal that intensity were close to 85% of maximal HR ideal to enhance aerobic fitness and soccer performance (Helgerud et al., 2001; Impellizzeri et al., 2006; Rampinini et al., 2007). However, to achieve cardiovascular fitness is essential performing moderate to vigorous physical activity, specifically 3x3 because if a team included five or more students per team, the mean percentage of intensity tends to declined dramatically (Helgerud, Engen, Wisloff, & Hoff, 2001; Impellizzeri et al., 2006; Balsom, 1999; Bangsbo, 1998; Hoff et al., 2002). Likewise, the present study show that with SSGs performed by mixed genders is possible to achieve an increase in female opportunity to play and to improve total physical activity. According to Dumith et al. (2010), motor performance in middle school students is higher in boys, and this difference tends to increase with age. Game-based PE curricula may be recommended to provide cardiovascular fitness required for health promotion. Further, students with difficulties can benefited when they are inserted in a context of cooperative work, what may happen with the most part of girls in football game (Dyson, Griffin, & Hastie, 2004) especially if they have the opportunity to play with boys, since the most part of girls, choose to play ball games because of fun, friendship, feeling good and the involvement of good coaches/ teachers (Trail and Anderson, 2002). Our study shows that 3-a-side soccer games is a good strategy to improve sports participation and decrease adversely influences as promoting a climate of equity in PE class, fighting at the same time sexual or gender stereotypes. Nonetheless, it appears: (a) that teachers need to be cognizant of the different physical activity opportunities for boys and girls in high school, and (b) improving PE classes for high school girls need to start with the elements found to be successful in the middle school. Some limitations of the study concern to have not any guarantee in advance that the groups of girls had different levels of performance of the boys at the beginning of each game, more observations are missing and different instruments to evaluate the proposal. In future, studies analyses of motivation should be included and also observed the number of encouragement of professor and the effect in foot-ball performance. In conclusion, this study demonstrates that exercise intensity in small-sided soccer games with 3 players can be manipulated by varying the type of game, especially with mixed genders. Using different combinations of these factors, teachers can modulate foot-ball exercise and control the training stimulus. For future studies, it is recommended to use different school ages and different type of SSGs, as well as a higher number of repetitions of the exercises evaluated and add measures of motivation and commitment in practice.

Conclusions

Or logical consequent. Your conclusion is your chance to have the last word on the subject. The conclusion allows you to have the final say on the issues you have raised in your paper, to summarize your thoughts, to demonstrate the importance of your ideas, and to propel your reader to a new view of the subject. It is also your opportunity to make a good final impression and to end on a positive note.

Practical Applications

PE teachers may take into account that mixed groups and especially matches exercises should be regular in soccer classes. This would enhance cardiovascular intensity, creating more opportunities to develop soccer skills, specially for female students. Teachers wanting to provide increase of physical activity during lessons might consider eliminating or modifying some exercises (e.g., using SSGs rather than regular-sided games).

References

Arnett, M.G., & Lutz, R.B. (2003). Measurement of Moderate to Vigorous Physical Activity of Middle School Girls, Using TriTrac Activity Monitors During Small-Sided, Game-Based Lessons. *Meas Phys Educ Exerc Sci, 7*(3): 149-159.

Balsom, P. (1999). Precision Football. Kempele, Finland: Polar Electro Oy.

Bangsbo, J. (1998). Optimal preparation for the World Cup in soccer. *Clin Sports Med, 17*, 697 – 709.

Borg, G. (1998). Borg's perceived exertion and pain scales. Champaign, IL, US: Human Kinetics.

Brito, J., Krustrup, P., & Bangsbo, J. (2010). Activity profile and physiological response to football training for untrained males and females, elderly and youngsters: influence of the number of players. *Scand J Med Sci Sports, 20*(1): 14-23.

Chow, J.Y., Davids, K., Button, C., Shuttleworth, R., Renshaw, I., & Araújo, D. (2007). The role of nonlinear pedagogy in physical education. *Educ Res Rev, 77*(3): 251-278.

Chow, J.Y., Davids, K., Button, C., Renshaw, I., Shuttleworth, R., & Uehara, L. (2009). Nonlinear pedagogy: implications for teaching games for understanding (TGfU). In: TGfU: Simply Good Pedagogy: Understanding a Complex Challenge, 14-17 May 2008,University of British Columbia, Vancouver.

Hopper, T.F., Butler, J., & Storey, B. (Eds.) TGfU: Simply Good Pedagogy: Understanding a Complex Challenge, Physical & Health Education (PHE) (pp. 131-143), Canada, University of British Columbia, Vancouver.

Duarte, R., Batalha, N., Folgado, H., & Sampaio, J. (2009). Effects of exercise duration and number of players in heart rate responses and technical skills during Futsal small-sided games. *Open Sports Sci J, 2*, 37-41.

Dumith, S.C., Hallal, P.C., Reis, R.S., & Kohl, H.W. (2011). Worldwide prevalence of physical inactivity and its association with human development index in 76 countries. *Prev Med,* 53(1-2): 24-28.

Dyson, B., Griffin, L., & Hastie, P. (2004). Sport Education, Tactical Games, and Cooperative Learning: Theoretical and Pedagogical Considerations. *Quest, 56*(2): 226-240.

Fink, J.S., Trail, G.T., & Anderson, D.F. (2002). Environmental factors associated with spectator attendance and sport consumption behavior: gender and team differences. *Sport Marketing Quarterly, 11,* 8-19.

Furrer, C.A. (2010). Coeducational versus single-sex physical education class: implication on female students' self-esteem and participation. *VAHPERD Journal, 31*(1).

Gréhaigne, J.F., & Godbout, P. (1995). Tactical knowledge in team sports from a constructivist and cognitivist perspective. *Quest, 47*(4): 490-505.

Griffin, L.L., Oslin, J.L., & Mitchell, S.A. (1995). An analysis of two instructional approaches to teaching net games. *Res Q Exerc Sport, 66*, A-64.

Hannon, J.C., & Williams, S.M. (2008). Should Secondary Physical Education Be Coeducational or Single-Sex? *J Phys Health Educ Recr Dance, 9*(2): 1-58.

Helgerud, J., Engen, L.C., Wisløff, U., & Hoff, J. (2001). Aerobic endurance training improves soccer performance. *Med Sci Sport Ex, 33*, 1925-1931.

Hoff, J., Wisloff, U., Engen, L. C., Kemi, O. J., & Helgerud, J. (2002). Soccer specific aerobic endurance training. *Br J Sports Med, 36*, 218 – 221.

Hughes, M.D., & Bartlett, R.M. (2002). The use of performance indicators in performance analysis. *J Sports Sci, 20*(10): 739-754.

Impellizzeri, F.M., Marcora, S.M., Castagna, C., Reilly, T., Sassi, A., Iaia, F.M., & Rampinini, E. (2006). Physiological and performance effects of generic versus specific aerobic training in soccer players. *Int J Sport Med, 27*: 483-492.

Jaffee, L., & Manzer, R. (1992). Girls' perspectives: Physical activity and self-esteem. *Melpomene Journal, 11*, 14-23.

Jones, R. (2005). What Do Children Most Enjoy about Summer Soccer Camp? Gender and Group Perceptions. *The Physical Educator, 62*, 2-13.

Krustrup, P., Dvorak, J., Junge, A., & Bangsbo, J. (2010a). Executive summary: The health and fitness benefits of regular participation in small-sided football games. *Scandinavian J Med Scie Sport, 20*(1): 132-135.

Krustrup, P., Aagaard, P., Nybo, L., Petersen, J., Mohr, M., & Bangsbo, J. (2010b). Recreational football as a health promoting activity: a topical review. *Scand J Med Sci Sports, 20*(1): 1-13.

Lawton, J. (1989). Comparison of two teaching methods in games. *Bull Phys Educ, 25*, 35-38.

Lee, S., Burgeson, C., Fulton, J., Spain, C. (2007). Physical education and physical activity: Results from the school health policies and programs study 2006. *J Sch Health, 77(*8): 435-463.

McKenzie, T.L., & Lounsbery M.A.F. (2009). School physical education: The pill not taken. *Am J Lifestyle Med, 3*(3): 219-225.

McKenzie, T.L., Prochaska, J.J., Sallis, J.F., & LaMaster, K.J. (2004). Coeducational and single-sex physical education in middle schools: impact on physical activity. *Res Q Exerc Sport, 75*(4): 446-449.

National Institute of Child Health and Human Development Study of Early Child Care and Youth Development [NICHD]. (2003). Frequency and intensity of activity of third-grade children in physical education. *Arch Pediatr Adolesc Med, 157*(2):185-190.

Pipher, M. (1994). Reviving Ophelia: Saving the selves of adolescent girls. New York: Ballantine.

Pritchard, T., McCollum, S., Sundal, J., & Colquit, G. (2014). Effect of the sport education tactical model on coeducational and single gender game performance. *Physical Educator, 71*(1): 0031-8981.

Rampinini, E., Bishop, D., Marcora, S.M., Ferrari Bravo, D.I., Sassi, R., & Impellizzeri, F.M. (2007). Validity of simple field tests as indicators of match-related physical performance in top-level professional soccer players. *Int J Sport Med, 28*: 228-235.

Randers, M.B., Nybo, L., Petersen, J., Nielsen, J.J., Christiansen, L., Bendiksen, M., Brito J, Bangsbo J, & Krustrup P. (2010). Activity profile and physiological response to football training for untrained males and females, elderly and youngsters: influence of the number of players. *Scand J Med Sci Sport, 20*, 14-23.

Rink, J.E., French, K.E., & Tjeerdsma, B.L. (1996). Foundations for the learning and instruction of sport and games. *J Teach Phys Educ, 15,* 399-417.

Sallis, J.F., McKenzie, T.L., Beets, M., et al. (2012). Physical education's role in public health: Steps forward and backward over 20 years and HOPE for the Future. *Res Q Exerc Sport, 83*(2): 125–135.

Smith, N.J., Lounsbery, M., & Mckenzie, T. (2012). Physical Activity in High School Physical Education: Impact of Lesson Context and Class Gender Composition. Journal of Physical Activity & Health.

Shimon, J. (2005). Red Alert: Gender Equity Issues in Secondary Physical Education. *J Phys Educ Recreat Dance, 76*(7): 6-10.

US Department of Health and Human Services. Physical activity guidelines for Americans. Washington, DC. (2008). Available at: www.health.gov/paguidelines. Accessed July 11, 2011.

Werner, P., Thorpe, R., & Bunker, D. (1996). Teaching Games for Understading: Evolution of a Model. *J Phys Educ Recreat Dance, 67*(1): 28-33.