Running head: MOTIVATION AND ENVIRONMENTAL CONTEXTS IN YOUTH SPORT

Does self-determined motivation interact with environmental contexts to influence moderate-to-vigorous physical activity during a girls' youth sport camp?

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Abstract

Objective: To explore whether basketball player's self-determined motivation interacts with environmental contexts and coach training to influence percentage time in moderate-to-vigorous physical activity (%MVPA).

Methods: A secondary analysis of data from 76 girls **(**mean±SD, 10.5±1.0y) was conducted. Players were classified as high (HSDM) or low (LSDM) self-determined motivation and randomised to trained (intervention) or untrained (control) coaches. Training included 2 workshops on strategies for activity-promoting practices. Girls were exposed to environment contexts (practices, games) led by a trained/untrained coach (depending on arm) and one without coaches (free time) daily. Girls wore accelerometers each day. Using mixed random-effects models, the influence of motivation, context, and training on %MVPA was analysed.

Results: Trained coaches' practices were associated with the greatest %MVPA with no difference between HSDM and LSDM players (38.28±1.77%; 37.64±1.80%; p=0.66). HSDM players had significantly greater %MVPA versus LSDM players during untrained coaches' practices (23.58±1.77%; 20.51±1.78%; p=0.03). During games with trained coaches, HSDM players had greater %MVPA compared to LSDM players (23.79±1.76%; 18.56±1.74%; p<0.001). No between-group difference in %MVPA during free time was found (12.85±0.82%; 13.39±0.84%; p=0.64).

Conclusion: The impact of individual differences in self-determined motivation on %MVPA during practices was attenuated when coaches were trained to implement activity-promoting practices.

Keywords: children, coach training, organised sport, motivation, physical activity.

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Participation in youth sports has been positively associated with health-related quality of life (Vella, Cliff, Magee, & Okely, 2014), psychological (Eime, Young, Harvey, Charity, & Payne, 2013) and social (Eime, et al., 2013) health, and meeting physical activity/screen time recommendations (Vella, Cliff, Okely, Scully, & Morley, 2013). Youth sports participation is also one of the strongest predictors of physical activity in adulthood (Telama, Yang, Hirvensalo, & Raitakari, 2006). It is, therefore, encouraging that approximately two-thirds of Australian children participate in some type of organised youth sport or dance (Australian Sports Commission, 2018).

Simply participating in sports, however, does not necessarily provide youth with ample opportunities to accumulate much-needed health enhancing physical activity (e.g., moderate-to-vigorous physical activity, MVPA; (Fenton, Duda, Appleton, & Barrett, 2017). Several observational studies have found that youth spend a large percentage of time during sport below the MVPA threshold (Guagliano, Rosenkranz, & Kolt, 2013; Leek et al., 2011; Schlechter, Rosenkranz, Milliken, & Dzewaltowski, 2016). It has also been shown that MVPA accumulated during sport varies across time (e.g., within practices) and is driven by changes in the structure of the environmental context or setting (i.e., its design and delivery) (Schlechter, Guagliano, Rosenkranz, Milliken, & Dzewaltowski, 2018). Therefore, the large percentage of time youth spend below the MVPA threshold could be a result of inefficiently structured coach-led practices and games.

Structure refers to the clarity of information a setting leader (e.g., a coach) provides to the participants about expectations and desired outcomes (Jang, Reeve, & Deci, 2010). Previous literature has shown that setting leaders can provide elements of structure within an environmental context by providing participants with: clear expectations and directions, instructing or leading activities only when needed, feedback, consistent routines, marking

boundaries and organising the transitions between activities (Brophy, 1986, 2006; Doyle, 2006; Huston-Stein, Friedrich-Cofer, & Susman, 1977; Skinner, 1995; Skinner and Belmont, 1993; Skinner, Zimmer-Gembeck, Connell, Eccles, & Wellborn, 1998). Studies have found, however, that coaches seldom plan practices ahead of time (Guagliano, Lonsdale, Rosenkranz, Kolt, & George, 2014) and spend a large percentage of time in management (e.g., transitioning between activities) or instructing (Guagliano et al., 2015; Guagliano, et al., 2013), which is negatively associated with MVPA (Dudley, Okely, Cotton, Pearson, & Caputi, 2012).

Inefficiently structured coach-led sports practices could also negatively affect the motivation of attending youth. With regard to self-determined (or autonomous) forms of motivation, several studies have found that basic needs satisfaction (i.e., supporting an individual's experience of competence, autonomy and relatedness) is an important antecedent, and is positively associated with MVPA, enjoyment, and persistence in youth sports participants (Fenton, et al., 2017; Fenton, et al., 2014; Sanchez-Oliva, Sanchez-Miguel, Leo, Kinnafick, & García-Calvo, 2014). When coach-led sports practices are autonomy supportive, children are more likely to experience enjoyment, exhibit higher levels of daily MVPA, and be autonomously motivated. (Fenton et al., 2017; Fenton et al., 2014).

Self-Determination Theory differentiates between autonomous and controlled forms of motivation and the two forms comprise five behavioural regulations, that can be organised along a continuum based on the extent to which one's motivation is self-determined (Deci and Ryan, 2008). Autonomous forms of motivation include (from most to least self-determined): *intrinsic motivation* (e.g., when being active because of inherent interest and enjoyment), *integrated regulation* (e.g., when being active because it aligns with core personal values and beliefs), and *identified regulation* (e.g., when being active because it is deemed important or beneficial; (Deci and Ryan, 2008). Controlled forms of motivation include (from most to least self-determined): *introjection* (e.g., when being active to ease guilt or gain approval from others) and *external regulation* (e.g., when being active to receive a reward or avoid punishment; (Deci and Ryan,

2008). *Amotivation*, the absence of intent to be active, also exists along this self-determination continuum (least self-determined; Deci and Ryan, 2008). Using an individual difference composite score, called a self-determination index (or relative autonomy index), the extent to which motivation is self-determined across environmental contexts can be measured (Lemyre, Treasure, & Roberts, 2006).

In summary, coaches are likely playing a large part in influencing their players' MVPA through the environment. Previously, we have shown that when intervened upon, coaches could be trained to structure more efficient practices that optimised MVPA opportunities (training described later), relative to a no-treatment control, resulting in significant increases in players' MVPA; but no between-group change in self-determined motivation was found (Guagliano, Lonsdale, Rosenkranz, Kolt, & George, 2015; Guagliano, Lonsdale, Rosenkranz, Parker, et al., 2015). It is, however, plausible that players' position on the self-determination index may interact with environmental contexts to impact MVPA in youth sport. To date, there have been relatively few studies examining how players' motivation interacts with environmental contexts to impact MVPA; to our knowledge, no study has considered multiple environmental contexts within a youth sport setting.

Using existing data from our intervention described above (Guagliano, Lonsdale, Rosenkranz, Kolt, et al., 2015), the purpose of this exploratory study was to examine whether environmental contexts (defined as practices and games of untrained and trained coaches and free time) and players of high or low self-determined motivation interacted, resulting in differences in the percentage of time spent in MVPA during a youth girls' basketball camp. We hypothesised that individual differences in self-determined motivation would contribute to significant differences in percentage of time in MVPA in all environmental contexts except during trained coach practices. During trained coach practices, we hypothesised individual differences in self-determined motivation would not contribute to differences in percentage of time MVPA. The reasons for the latter hypothesis were: (1) compared to games and free time,

during the practice context, coaches have the greatest ability to influence their players' activity (e.g., based on how practice was structured and through modelling) and (2) training coaches to optimise practices for MVPA opportunities (e.g., using circuits instead of lines, providing choice) may have led to greater quality and equality of participation.

Methods

Study Design, Setting, and Participants

The current study was an exploratory secondary analysis examining the interaction between individual differences in self-determined motivation and environmental contexts. Data for the current study were derived from a 2-armed, parallel-group randomised controlled trial registered with the Australian New Zealand Clinical Trials Registry (ACTRN12613001099718). The randomised controlled trial study protocol (Guagliano, Lonsdale, Kolt, & Rosenkranz, 2014) and main findings (Guagliano, Lonsdale, Rosenkranz, Kolt, et al., 2015; Guagliano, Lonsdale, Rosenkranz, Parker, et al., 2015) have been published elsewhere.

In brief, the intervention aimed to assess whether a coach trained to structure practices that optimised MVPA opportunities, relative to a no-treatment control, could increase players' MVPA during practices over a 5 consecutive day girls' basketball camp (hereafter referred to as the camp). Baseline measures were collected at the end of the first day and follow-up measures were collected at the end of the fifth day of the camp. After baseline measures, 4 (out of 8) coaches were randomly allocated to receive training through 2 educational workshops (2 hours in duration each) after each of the first 2 days of the camp. Generally, coaches received training on how to structure efficient practices that optimised players' opportunities for MVPA. More specifically, coaches received training on several topics related to the design and delivery of practices, including: strategies to increase MVPA and decrease inactivity, providing choice, self-monitoring, and goal-setting. For example, a strategy taught to increase MVPA would be to use circuits that offered choice (e.g., choice of jump shot or lay-up) rather than lines. This modification can support competence, for example, by allowing players to move at their own

pace and supports autonomy by providing choice. During each workshop, coaches were also given time to reflect on their practices, discuss their coach feedback form (based on direct observation of their practices), role play, and plan their next practices. Coaches allocated into the control group were asked to coach as usual. Regarding players, they were randomly assigned to either the intervention or control arm, where they were either exposed to a coach who received training or a coach who did not, respectively.

The camp ran simultaneously across 2 sports venues in Sydney, Australia. Each venue hosted 38 players and 4 coaches. Each camp day included 2 practices (45 minutes each), 2 games (40 minutes each), and 3 periods of free time (15 minutes each). Coaches were given half of a basketball court to deliver practices. A double round-robin tournament was created for the 2 games per day, which was played 5 vs. 5 on a full basketball court. Finally, during the free time periods, players were free to do as they chose (e.g., talk amongst each other, eat, play basketball or other games of their choice). Each coach had a maximum of 10 players during practices and games, which is a common team size in youth basketball. Start and stop times of each practice, game, and free time period were recorded daily to define the time segment of each environmental context.

The current study adopted a strip-plot design (Milliken, 2003) to examine the interaction of individual differences (self-determined motivation) and environmental characteristics (context) on physical activity during the camp days. The daily time segmented period was the experimental unit and physical activity was an outcome characteristic of environmental context (i.e., trained coach practice, untrained coach practice, trained coach game, untrained coach game, free time) and individual difference (i.e., high self-determined motivation, low self-determined motivation). None of our previously published studies have segmented time periods throughout the camp day or examined the interaction between individual differences and environmental contexts. For the present study, only environmental contexts (and players in

attendance during those environmental contexts) from camp days 3–5 were included in the study, as they occurred after coach training.

A total of 76 female basketball players, aged 9-12 (mean ± standard deviation age = 10.5 ± 1.0y) participating in a 5-day camp were eligible for inclusion in the current study. Girls were recruited because they have been identified as a high priority group for physical activity promotion (Biddle, Braithwaite, & Pearson, 2014) and; girls in the above range represent the age range with the highest participation rates (83%) among Australian girls in youth sports (Australian Sports Commission, 2018). Parental consent and child assent was obtained for all participants. The study received ethics approval from the Human Research Ethics Committee of Western Sydney University (approval number: H10215).

Outcome Measures

Physical activity. ActiGraph GT3X+ accelerometers (ActiGraph; Pensacola, FL) were used to measure physical activity levels. Players wore accelerometers at the hip during camp hours for the duration of the basketball camp. Accelerometers were initialized once at the start of the week and set to record data at a sampling rate of 30 Hz. At the end of the camp, raw counts were downloaded using ActiLife software and integrated into 15-second epochs. The start and end times of each practice, game, and free time periods were recorded and used to define the parameters of each environmental context (i.e., practices, games, free time). Evenson and colleagues' (2008) cut-points were then applied to estimate physical activity intensity during each environmental context.

Self-determined motivation. Players completed the 14-item Situational Motivation Scale, which assesses constructs of intrinsic motivation, identified regulation, external regulation, and amotivation (Standage, Duda, Treasure, & Prusak, 2003). The Situational Motivation Scale does not assess constructs of introjected or integrated regulation. Players responded to questions on a 7-point Likert scale (1 = not true at all, 7 = very true). A self-determination index was then created using the following formula: (2*intrinsic motivation) +

identified regulation – external regulation – (2*amotivation); which has been used previously (Lemyre, et al., 2006). The self-determination index scores ranged from −18 to 18, where higher scores are indicative of greater self-determined motivation. The Situational Motivation Scale has received empirical support for reliability and validity (Standage, et al., 2003).

Statistical Analysis

To investigate whether players' self-determined motivation interacted with environmental contexts, mixed random effects models (with SAS PROC MIXED) were used. Player (nested within site, day, and self-determination index), coach (nested within site) and day-by-coach (nested within site and self-determination index) were used as random effects. Age and BMI *z*-score were covariates, because of their relationship with physical activity (Troiano et al., 2008).

Similar to a previous study (Lonsdale, Sabiston, Raedeke, Ha, & Sum, 2009), we split players into tertile groups to create stark contrast between high and low motivation players using their baseline self-determination index scores (measured at the end of the first camp day) prior to conducting the analyses. Players were included in the analyses (n = 50) if they had low self-determined motivation (i.e., lowest tertile; n = 25) or high self-determined motivation (i.e., highest tertile; n = 25). All statistical analyses were conducted in SAS (Version 9.4; Cary, NC, USA) and statistical significance was set at $p < 0.05$.

Results

Players' characteristics are presented in Table 1. By design, high and low motivation groups significantly differed in mean (± SD) self-determination index scores (13.0 ± 1.4 vs. 2.6 ± 3.8, respectively). No other significant differences between low and high motivation groups were found for any other demographic variable.

No differences were found between the unadjusted model and the model adjusted for age and BMI z-score, adjusted findings are presented henceforth. Percentage of time in MVPA was an outcome of an interaction between self-determined motivation and environmental

context ($F = 4.75$, $p < 0.001$). Least-squared mean estimates of the percentage of time high and low motivation players spent in MVPA by condition and environmental context are presented in Table 2. Overall, players with high motivation spent a significantly greater percentage of time in MVPA than players with low motivation (27.17 ± 1.20% [SE] vs. 24.49 ± 1.21% [SE]; $t = 3.09$, $p = 0.002$). During practices delivered by untrained coaches (i.e., control coaches), high motivation players spent a significantly greater percentage of time in MVPA compared to low motivation players (23.58 ± 1.77% vs. 20.51 ± 1.78%; $p = 0.03$). In contrast, during practices delivered by trained coaches (i.e., intervention coaches), there was no significant difference in the percentage of time spent in MVPA between players with high and low motivation, respectively (38.28 ± 1.77% vs. 37.64 ± 1.80%; $p = 0.66$). During games, high motivation players spent a greater percentage of time in MVPA compared to low motivation players when led by trained coaches (23.79 ± 1.76% vs. 18.56 ± 1.74%; $p < 0.001$). No significant difference between motivation groups was found when led by untrained coaches (23.03 ± 1.80% vs. 21.24 ± 1.84%; $p = 0.25$). There was also no difference between high and low motivation players during free time, respectively (12.85 ± 0.99% vs. 13.30 ± 1.01%; $p = 0.70$).

Discussion

The current study explored whether players' self-determined motivation interacted with environmental contexts defined by context task and coach training that occurred during a youth basketball camp to impact the percentage of time spent in MVPA. Findings showed that players' self-determined motivation interacted with environmental contexts to influence MVPA. Our findings also showed that training coaches to optimise practices for MVPA opportunities was associated with a higher percentage of time spent in MVPA (compared to untrained coaches) during practices, and it attenuated inter-individual differences in players' physical activity that result from varying levels of self-determined motivation. That is, motivation classification did not appear to influence players' physical activity when coaches were trained to implement an efficient, structured, and activity-promoting practice environment and could directly influence

their players. Indeed, we observed significant differences in physical activity between high and low self-determined players in practices led by untrained coaches. During games, however, training coaches was not associated with attenuated physical activity levels between motivation groups. This could be because coaches are limited in their ability to structure the game context and directly influence their players. To illustrate, during games coaches are less able to influence physical activity intensity because they are bound by the rules of the game and constrained to their bench; whereas, during practices coaches can influence physical activity intensity because they can structure practices as they choose and can participate. Lonsdale et al. (2009) provided further rationale for this finding, where the authors explained that a setting leader's (e.g., coach, physical education teacher) ability to influence an environment might assist in providing motivation for low-motivation (i.e., less self-determined) individuals to be physically active. But, when a setting leader's ability to influence the environment is reduced or removed (e.g., during games or free time), it is likely that low-motivation individuals would decrease their level of physical activity. Similarly, a summer camp study found that girls spent the greatest percentage of time in MVPA during leader-led (i.e., able to directly influence participants) environmental contexts compared to the free play context (Guagliano et al., 2017). Alternatively, coaches could have selected self-determined players to have more playing time during games and this would have eliminated any impact of the environmental structure of game play on low motivation players.

Despite it being a positive finding that training coaches attenuated differences in MVPA between high and low motivation players, it is unclear how this may affect players' long-term participation in sports; particularly among the low motivation players. The importance of players' perceived self-determined motivation, therefore, should not be discounted. Self-determined forms of motivation have been positively associated with MVPA, enjoyment, and persistence; and negatively associated with sedentary time and dropout among youth sport participants within and outside of the youth sports setting (Balish, McLaren, Rainham, &

Blanchard, 2014; Fenton, et al., 2017; Fenton, et al., 2014). Basic needs satisfaction is an important antecedent to self-determined forms of motivation in youth sports participants (Fenton, et al., 2017; Fenton, et al., 2014). Along with being structured, efficient, and activity-promoting practice, these coach-led environments should also support basic needs to provide the best chances for youth to develop self-determined motivation to participate in sport.

Currently, many youth sport organisations do not require coaches to receive any formal coach training (Vella et al., 2016). Additionally, the coach training programs (i.e., accreditation courses) that are available generally do not provide coaches with direction on how to promote physical activity or create structured environments that foster autonomous motivation (Vella, et al., 2016), despite several frameworks being available (Lubans et al., 2017; Weaver, Webster, & Beets, 2013). Schlechter et al. (2016) found no difference in the percentage of time youth flag football players spent in MVPA between coaches who participated in a standard coach training program compared to those with no training. A change in what is currently being delivered in coach training programs is needed to increase health-enhancing physical activity during youth sports and to improve the likelihood of lifelong participation in sports.

Strengths, Limitations, and Delimitations

Some potential limitations should be considered when interpreting the current findings. First, we used players' baseline scores to classify them as having high or low motivation. It is possible that these scores may have differed by day and environmental context (i.e., practice, game, free time) during the basketball camp. It would have been too burdensome to the participant, however, to obtain self-reported motivation at the end of each practice, game, and free-time period. Second, despite being instructed to distribute playing time equally, it is possible that coaches (consciously or unconsciously) selected more motivated players to participate in games. Consequently, the lower percentage of MVPA in low motivation players could partly be driven by greater bench time. Lastly, we may have been limited by a modest sample size. In addition, our study was delimited by only including girls and only exposing

participants to one sport, which may impact the generalisability of this study. Despite these limitations and delimitations, this was a novel study that used objective measurement that allowed for a rigorous description of MVPA and thorough recording of environmental context start and stop times.

Conclusion

This study was a novel exploration into the impact of environmental contexts and individual-level differences in self-determined motivation on percentage of time in MVPA during a youth sport setting. Our findings indicated that the impact of individual differences on self-determined motivation on MVPA during practices (but not during games) was attenuated when coaches were trained to implement efficient practices. Differences in environmental contexts which vary the coaches' ability to influence players' physical activity intensity may provide some rationale for the findings during games. Since the majority of Australian children and adolescents participate in youth sport, it may represent one of the widest reaching out-of-school settings. Therefore, deliberate and purposeful attempts are needed to train coaches to provide players with enjoyable, well-structured, and basic needs supportive sporting experiences that foster autonomous motivation and physical activity. Future studies could attempt to replicate our findings using leaders in other physical activity settings (e.g., physical education teachers, summer camps leaders), sports, populations (e.g., boys), and with a larger sample size. In the future, researchers could also consider using ecological momentary assessment (similar to Quested, Duda, Ntoumanis, & Maxwell, 2013) to better understand players' perceptions of the environmental contexts before and after coach training. The effect of this coach training on player motivation in the longer term could also be explored (e.g., over a season rather than a five-day camp).

References

Australian Sports Commission. (2018). *AusPlay focus: Children's participation in organised physical activity outside of school hours*. Canberra: Australian Sports Commission. https://www.clearinghouseforsport.gov.au/__data/assets/pdf_file/0012/796827/AusPlay_focus_Children_Participation.pdf

Balish, S. M., McLaren, C., Rainham, D., & Blanchard, C. (2014). Correlates of youth sport attrition: A review and future directions. *Psychology of Sport and Exercise, 15*(4), 429-439. doi:10.1016/j.psychsport.2014.04.003

Biddle, S. J., Braithwaite, R., & Pearson, N. (2014). The effectiveness of interventions to increase physical activity among young girls: A meta-analysis. Preventive Medicine, 62, 119-131. doi:10.1016/j.ypmed.2014.02.009

Brophy, J. (1986). Teacher influences on student achievement. *American Psychologist, 41*(10), 1069-1077. doi:10.1037/0003-066X.41.10.1069

Brophy, J. (2006). Observational research on generic aspects of classroom teaching. In P. A. Alexander & P. H. Winne (Eds.), *Handbook of educational psychology* (2nd ed., 755-780). Mahwah, NJ: Erlbaum.

Deci, E. L., & Ryan, R. M. (2008). Facilitating optimal motivation and psychological well-being across life's domains. *Canadian Psychology, 49*(1), 14-23. doi: 10.1037/0708-5591.49.1.14

Doyle, W. (2006). Ecological approaches to classroom management. In C. M. Evertson & C. S. Weinstein (Eds.), *Handbook of classroom management: Research, practice, and contemporary issues* (97-125). Mahwah, NJ: Erlbaum.

Dudley, D. A., Okely, A. D., Cotton, W. G., Pearson, P., & Caputi, P. (2012). Physical activity levels and movement skill instruction in secondary school physical education. *Journal of Science and Medicine in Sport, 15*(3), 231-237. doi: 10.1016/j.jsams.2011.10.005

Eime, R. M., Young, J. A., Harvey, J. T., Charity, M. J., & Payne, W. R. (2013). A systematic review of the psychological and social benefits of participation in sport for children and adolescents: Informing development of a conceptual model of health through sport. *International Journal of Behavioral Nutrition & Physical Activity, 10*. doi: 10.1186/1479-5868-10-98)

Evenson, K. R., Catellier, D. J., Gill, K., Ondrak, K. S., & McMurray, R. G. (2008). Calibration of two objective measures of physical activity for children. *Journal of sports sciences, 26*(14), 1557-1565. doi: 10.1080/02640410802334196

Fenton, S. A., Duda, J. L., Appleton, P. R., & Barrett, T. G. (2017). Empowering youth sport environments: Implications for daily moderate-to-vigorous physical activity and adiposity. *Journal of Sport and Health Science, 6*(4), 423-433. doi: 10.1016/j.jshs.2016.03.006

Fenton, S. A., Duda, J. L., Quested, E., & Barrett, T. (2014). Coach autonomy support predicts autonomous motivation and daily moderate-to-vigorous physical activity and sedentary time in youth sport participants. *Psychology of Sport and Exercise, 15*(5), 453-463. doi: 10.1016/j.psychsport.2014.04.005

Guagliano, J. M., Lonsdale, C., Kolt, G. S., & Rosenkranz, R. R. (2014). Increasing girls' physical activity during an organised youth sport basketball program: A randomised controlled trial protocol. *BMC Public Health, 14*, 383. doi: 10.1186/1471-2458-14-383

Guagliano, J. M., Lonsdale, C., Rosenkranz, R. R., Kolt, G. S., & George, E. S. (2014). Do coaches perceive themselves as influential on physical activity for girls in organised youth sport? *PLoS ONE, 9*(9), p e105960. doi: 10.1371/journal.pone.0105960

Guagliano, J. M., Lonsdale, C., Rosenkranz, R. R., Kolt, G. S., & George, E. S. (2015). Increasing girls' physical activity during an organized youth sport basketball camp: A randomized controlled trial. *Journal of Science and Medicine in Sport, 18*, 412-417. doi:10.1016/j.jsams.2015.01.014

Guagliano, J. M., Lonsdale, C., Rosenkranz, R. R., Parker, P. D., Agho, K. E., & Kolt, G. S. (2015). Mediators effecting moderate-to-vigorous physical activity and inactivity for girls from an intervention program delivered in an organised youth sports setting. *Journal of Science and Medicine in Sport, 18,* 678-683. doi: 10.1016/j.jsams.2015.05.005

Guagliano, J. M., Rosenkranz, R. R., & Kolt, G. S. (2013). Girls' physical activity levels during organized sports in Australia. *Medicine & Science in Sports & Exercise, 45*(1), 116-122. doi:10.1249/MSS.0b013e31826a0a73

Guagliano, J. M., Updyke, N. J., Rodicheva, N. V., Rosenkranz, S. K., Dzewaltowski, D. A., Schlechter, C. R., & Rosenkranz, R. R. (2017). Influence of session context on physical activity levels among Russian girls during a summer camp. *Research Quarterly for Exercise and Sport, 88*(3), 352-357. doi:10.1080/02701367.2017.1331291

Huston-Stein, A., Friedrich-Cofer, L., & Susman, E. J. (1977). The relation of classroom structure to social behavior, imaginative play, and self-regulation of economically disadvantaged children. *Child Development, 48*(3), 908-916.

Jang, H., Reeve, J., & Deci, E. L. (2010). Engaging students in learning activities: It is not autonomy support or structure but autonomy support and structure. *Journal of Educational Psychology, 102*(3), 588-600. doi:10.1037/a0019682

Leek, D., Carlson, J. A., Cain, K. L., Henrichon, S., Rosenberg, D., Patrick, K., & Sallis, J. F. (2011). Physical activity during youth sports practices. *Archives of Pediatrics & Adolescent Medicine, 165*(4), 294-299. doi: 10.1001/archpediatrics.2010.252

Lemyre, P.-N., Treasure, D. C., & Roberts, G. C. (2006). Influence of variability in motivation and affect on elite athlete burnout susceptibility. *Journal of Sport and Exercise Psychology, 28*(1), 32-48. doi:10.1123/jsep.28.1.32

Lonsdale, C., Sabiston, C. M., Raedeke, T. D., Ha, A. S., & Sum, R. K. (2009). Self-determined motivation and students' physical activity during structured physical education lessons

and free choice periods. *Preventive Medicine, 48*(1), 69-73. doi: 10.1016/j.ypmed.2008.09.013

Lubans, D. R., Lonsdale, C., Cohen, K., Eather, N., Beauchamp, M. R., Morgan, P. J., . . . Smith, J. J. (2017). Framework for the design and delivery of organized physical activity sessions for children and adolescents: Rationale and description of the 'SAAFE' teaching principles. *International Journal of Behavioral Nutrition and Physical Activity, 14.* doi:10.1186/s12966-017-0479-x

Milliken, G. A. (2003). *Multilevel designs and their analyses.* Proceedings 28th annual SAS users group international conference.

Quested, E., Duda, J. L., Ntoumanis, N., & Maxwell, J. P. (2013). Daily fluctuations in the affective states of dancers: A cross-situational test of basic needs theory. *Psychology of Sport and Exercise, 14*(4), 586-595. doi:10.1016/j.psychsport.2013.02.006

Sanchez-Oliva, D., Sanchez-Miguel, P. A., Leo, F. M., Kinnafick, F.-E., & García-Calvo, T. (2014). Physical education lessons and physical activity intentions within Spanish secondary schools: A self-determination perspective. *Journal of Teaching in Physical Education, 33*(2), 232-249. doi:10.1123/jtpe.2013-0043

Schlechter, C. R., Guagliano, J. M., Rosenkranz, R. R., Milliken, G. A., & Dzewaltowski, D. A. (2018). Physical activity patterns across time-segmented youth sport flag football practice. *BMC Public Health, 18,* 226. doi:10.1186/s12889-018-5108-3

Schlechter, C. R., Rosenkranz, R. R., Milliken, G. A., & Dzewaltowski, D. A. (2016). Physical activity levels during youth sport practice: Does coach training or experience have an influence? *Journal of Sports Science35*(1), 22-28. doi:10.1080/02640414.2016.1154593

Skinner, E. A. (1995). *Perceived control, motivation, and coping*: Newbury Park, CA: Sage.

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology, 85*(4), 571-581. doi:10.1037/0022-0663.85.4.571

Skinner, E. A., Zimmer-Gembeck, M. J., Connell, J. P., Eccles, J. S., & Wellborn, J. G. (1998). Individual differences and the development of perceived control. *Monographs of the Society for Research in Child Development, 63*(2/3), i-231. doi:10.2307/1166220

Standage, M., Duda, J. L., Treasure, D. C., & Prusak, K. A. (2003). Validity, reliability, and invariance of the Situational Motivation Scale (SIMS) across diverse physical activity contexts. *Journal of Sport & Exercise Psychology, 25*(1), 19-43. doi: 10.1123/jsep.25.1.19

Telama, R., Yang, X., Hirvensalo, M., & Raitakari, O. (2006). Participation in organized youth sport as a predictor of adult physical activity: A 21-year longitudinal study. *Pediatric Exercise Science, 18*(1), 76-88. doi: 10.1123/pes.18.1.76

Troiano, R. P., Berrigan, D., Dodd, K. W., Mâsse, L. C., Tilert, T., & McDowell, M. (2008). Physical activity in the United States measured by accelerometer. *Medicine & Science in Sports & Exercise, 40*(1), 181-188. doi: 10.1249/mss.0b013e31815a51b3

Vella, S. A., Cliff, D. P., Magee, C. A., & Okely, A. D. (2014). Sports participation and parent-reported health-related quality of life in children: Longitudinal associations. *The Journal of Pediatrics, 164*(6), 1469-1474. doi: 10.1016/j.jpeds.2014.01.071

Vella, S. A., Cliff, D. P., Okely, A. D., Scully, M. L., & Morley, B. C. (2013). Associations between sports participation, adiposity and obesity-related health behaviors in Australian adolescents. *International Journal of Behavioral Nutrition and Physical Activity, 10*, 113. doi: 10.1186/1479-5868-10-113

Vella, S. A., Schranz, N. K., Davern, M., Hardy, L. L., Hills, A. P., Morgan, P. J., . . . Tomkinson, G. (2016). The contribution of organised sports to physical activity in Australia: Results and directions from the Active Healthy Kids Australia 2014 Report Card on physical activity for children and young people. *Journal of Science and Medicine in Sport, 19*(5), 407-412. doi: 10.1016/j.jsams.2015.04.011

456 Weaver, R. G., Webster, C., & Beets, M. W. (2013). LET US Play: Maximizing physical
457 activity in physical education. *Strategies*, *26*(6), 33-37.
458 doi:10.1016/j.ypmed.2015.03.012

Table 1. Participants' characteristics.

Characteristics	High self-determined motivation group[1] (n = 25)	Low self-determined motivation group[2] (n = 25)
Age, mean (SD), y	9.8 (1.0)	10.1 (1.0)
Height, mean (SD), cm	146.6 (9.0)	146.3 (12.0)
Weight, mean (SD), kg	38.8 (7.9)	41.9 (13.1)
Waist circumference, mean (SD), cm	64.3 (6.8)	66.8 (9.4)
BMI, mean (SD)	18.0 (2.9)	19.3 (4.5)
Players born in Australia, No. (%)	23 (92.0)	23 (92.0)
Plays organized basketball, No. (%)	22 (88.0)	21 (84.0)
Number of practices/week, mean (SD)	1.2 (0.5)	1.4 (0.6)
Practices duration, mean (SD), mins	95.3 (42.7)	84.7 (54.1)
Number of games/week, mean (SD)	1.1 (0.3)	1.4 (0.6)
Game duration, mean (SD), mins	55.3 (13.8)	55.6 (12.8)
Self-determination index score, mean (SD)	13.0 (1.4)*	2.6 (3.8)

Abbreviations. cm, centimetres; kg, kilograms; No., number; SD, standard deviation; y, years.

Notes. [1]high self-determined motivation group = participants' self-determination index scores were in the highest tertile; [2]Low self-determined motivation group = participants' self-determination index scores were in the lowest tertile.

* = significant between-group difference ($p < 0.05$).

Table 2. Least-squared mean estimates of percentage of MVPA time by condition (defined by context task, coach training, and participant SDM)[1].

Condition			Frequency	%time MVPA (SE)	Diff Effect	95% CI	DF	*t*	*p*
Practice	Trained coach	High SDM[2]	48	38.28 (1.77)					
Practice	Trained coach	Low SDM[3]	48	37.64 (1.80)					
					0.63	-2.22 – 3.50	596	0.44	0.66
Practice	Untrained coach	High SDM[2]	48	23.58 (1.77)					
Practice	Untrained coach	Low SDM[3]	48	20.51 (1.78)					
					3.07	0.34 – 5.80	563	2.21	0.03
Game	Trained coach	High SDM[2]	48	23.79 (1.76)					
Game	Trained coach	Low SDM[3]	48	18.56 (1.74)					
					5.22	2.58 – 7.88	555	3.88	<0.001
Game	Untrained coach	High SDM[2]	48	23.03 (1.80)					
Game	Untrained coach	Low SDM[3]	48	21.24 (1.84)					
					1.79	-1.26 – 4.84	626	1.15	0.25
Free Time	No coach	High SDM[2]	9	12.85 (0.99)					
Free Time	No coach	Low SDM[3]	9	13.30 (1.01)					
					-0.44	-2.77 – 1.88	64	-0.39	0.70

Abbreviations: %time, percentage of time; MVPA, moderate-to-vigorous physical activity; SDM, self-determined motivation.

Notes. [1]adjusted for age and body mass index *z*-score; [2]High SDM group = participants' self-determination index scores were in the highest tertile; [3]low SDM group = participants' self-determination index scores were in the lowest tertile. Alpha was set at $p < 0.05$.