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Application of an Educational Resource for Parents of Seven-Year-Old Children Diagnosed with Developmental Coordination Disorder

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Abstract

The present study aims to discuss the application of educational resource "Children with Developmental Coordination Disorder: at Home, at School and in the Community" (Missiuna, Rivard, & Pollock, 2011) for parents of seven-year-old children of a public school in a Brazilian city. The booklet aims to help parents and teachers identify and manage school-aged children with developmental coordination disorder (DCD). Methods: The contents of the booklet were used in a group of four parents of children previously identified with DCD in the school environment using a workshop. Results: The meetings of the parents were oriented to the characterization of the disorder. The activities helped parents understand the difficulties of their children. Conclusion: In this study it was found that the use of the educational resources together with games proved to be an important approach to working with parents of children with DCD. However, it is important to expand the number of participants in future studies.

Keywords

Educational Resources, Parents, Developmental Coordination Disorder (DCD), School

1. Introduction

The early detection of childhood developmental disorders is considered essential to prevent future problems in

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life, since a diagnosis early enough to implement intervention activities increases their chances of reaching their full potential and living normally among their peers. The Developmental Coordination Disorder (DCD) occurs when there is delayed development of motor skills or difficulty coordinating movements, not justified by general medical conditions or mental retardation, resulting in poor academic performance, school and daily activities (Missiuna, Rivard, & Pollock, 2011). With prevalence estimates of approximately 6% (APA, 2013), Developmental Coordination Disorder (DCD) is a condition that deserves special attention because of its impact on school activities and daily life. It may also be associated with other disorders such as learning disabilities and social and emotional problems, primarily attention deficit hyperactivity disorder (Missiuna et al., 2007; Polatajko & Cantin, 2006; Pereira, Araújo, & Mattos, 2005).

The diagnosis should be made as early as possible, since children with DCD experience failure and frustration in their academic and daily lives are commonly labeled as lazy, uncoordinated, unmotivated, or clumsy (Araujo, 2010).

The school environment is most promising for the identification of children with DCD. The daily school routine demands virtually the entire spectrum of motor skills and has the advantage of housing a privileged observer, the teacher (Silva et al., 2006). Along with disorder identification, it is also important to develop strategies with parents and teachers to help children with DCD manage success in their daily activities and promote their inclusion in the school and community.

Consequently, Missiuna, Rivard, & Pollock (2011) wrote the booklet entitled "Children with Developmental Coordination Disorder: At Home, at School and in the Community" that was translated to Portuguese by Magalhães and directed to parents and teachers to help them identify the signs of DCD and manage their children's difficulties. The booklet presents simple concepts of motor coordination planning and the consequences of disabilities in this process, addresses the physical, emotional and academic characteristics of children with DCD, and emphasizes the important role of the occupational therapist in analyzing motor skill development and determining the ability of a child to cope with the demands and activities of everyday life. The booklet also offers strategies for parents and teachers to use at home and at school (in the classroom and in physical education).

This study aims to describe the results of application of a booklet in a group of four parents of seven-year-old children identified with signs of developmental coordination disorder DCD at a school in the municipality of São Carlos, São Paulo, Brazil. The booklet discusses strategies for dealing with the difficulties resulting from DCD.

2. Methodology

The present report consists of the second phase of a larger study that identified seven years old children with DCD hypothesis to a municipal school in the interior of São Paulo, Brazil. It is a report of a workshop that served as a feedback to parents of children identified with the disorder. The workshops were configured as a place for reflection and sharing life experiences on the issues raised and allow for the identification of the main topics required to understand the problem (Chiesa & Westphal, 1995).

Parents of four of the seven children identified in the school with the disorder agreed to participate in the meetings. Teachers of the identified students were also invited, but none were available to attend. Three meetings were scheduled with the participants as well.

Participated in the workshop two fathers and two mothers of seven years children identified with signs of DCD, without the presence of children; participants lived in the outskirts of the city. The workshops were scheduled simultaneously for all parents at night in the children's own school environment. The school was the place chosen for the workshop to be of easy access to parents and to have an appropriate meeting space. All of the meetings were held within the period of one month. In each meeting notes for future discussions were held. The meetings were directed by the researcher.

Workshop Description

First meeting

The activity consisted of a game in which there were two sets of cards, one with the typical characteristics in children with DCD and the other with orientations on how to manage them at home or at school. The cards with the characteristics were placed on a table and the cards with orientations were divided and given to the parents. Each parent in turn withdrew a characteristics card and read it aloud to another parent, who verified whether he

had a matching orientation card that could be used. Researcher participation was also necessary to define the characteristics and orientations and give examples as needed. There were also blank cards on which the parents could write attitudes that they believed could help their children.

Second meeting

It was presented the booklet "Children with Developmental Coordination Disorder: At Home, at School and in the Community" and the researcher explained that its contents would be worked on during the meeting. The items of booklet involve the characteristics of DCD and the role of parents, educators and community in dealing with the children in their routine activities.

It was exposed to the parents as occurring motor coordination difficulties, from the explanation of a poster made of cardboard with a picture that shows the system of planning actions, contained in the booklet. Was used as an example the need for motor planning to climb a ladder to facilitate understanding, and parents claimed to have understood and even sometimes realize that their children have some of these difficulties (**Figure 1**).

Third meeting

The purpose of this activity was that parents perform motor and daily life tasks in a given time in order to reflect on the motor planning necessary for each task and the difficulties that their children could feel when performing motor activities in their daily lives. A circuit of motor activities was performed. First, each participant had to swing a hula hoop, assemble a structure using five "domino" pieces, jump hopscotch the best they could to the other side of the room, assemble a minimum of a four-piece jigsaw puzzle, skip rope six times, and tie in a shoelace (**Figure 2**). Each game had to be performed in a maximum of 15 seconds, and as soon as the first participant went on to the second game, the next participant started the circuit. After the activity parents were encouraged to discuss them and give testimonials about their feelings.

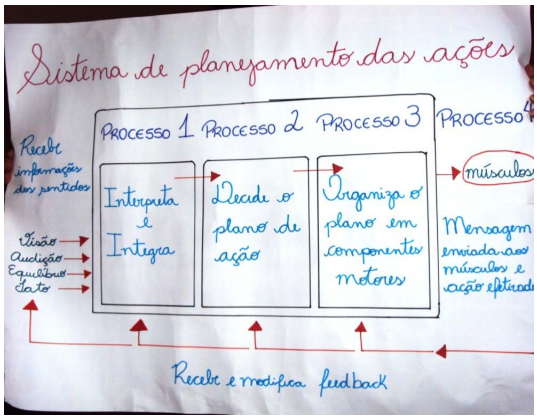

Figure 1. Explanatory framework operating system planning actions (adapted of Missiuna, Rivard, & Pollock, 2011).

Figure 2. Toys used in the circuit.

3. Results

The parents identified the characteristics mentioned in the cards to those presented by their children, especially the ones related to academic, playtime, and everyday life activities that involve motor components. However, they added nothing.

Parents actively participated in the discussion and asked questions about the disorder and about the material presented.

Mother 1 alleged that her daughter had all of the characteristics mentioned in the cards as well as more pronounced difficulties in reading and writing, focusing, physical play, and the preference to play alone. At the end of the game, the orientation topic in the booklet was reviewed and handed to the parents. Mother 1 thanked the researcher and highlighted that:

"*The workshops helped me better understand my daughter's difficulties and now I believe I know how to deal with them*."

The parents were involved in all games, which demonstrated their dedication despite their unfamiliarity with the games.

The parents commented on their feelings about the difficulties faced.

Mother 2 said:

"*It was 'cool' to experience games that are part of my son's routine and how something that seems simple becomes difficult when we do not do it often or when there is an obligation of doing it at a certain velocity*."

Father 1 agreed, saying that:

"*There might still be a sense of frustration for being unable to do what is asked and the shame of being the slowest or the one that was unable to do it*." (he took a long time to assemble the jigsaw puzzle)

The parents revealed the difficulty of their children, who are focused on classroom activities like slow handwriting and excessive force used when writing with a pencil as well as difficulties in daily life activities like clothing (clothes put on inside out, not being able to tie shoelaces), eating (taking too long to use a fork and knife), and playing (running, jumping, playing ball).

Afterwards, it was explained how motor coordination difficulties in children occur using a figure in the manual, a demonstrative table of the action plan system (**Figure 1**).

Mother 2 said she understands:

"*How important the role of professionals like the occupational therapy in school is*, *advising parents about the difficulties of children and how they occur*."

Father 2 added:

"*It is very important to involve parents in the school life of their children because most of the time they might not realize the difficulties that the children face and they might even feel their hands are tied for not knowing how to act*."

At the end of the workshop, time was given for questions, opinions, and suggestions. The parents thanked the researcher for visiting the school environment and providing guidance. They highlighted the belief in the importance of the University's role in projects within the schools that help parents and teachers with recent and differentiated knowledge. The booklet with the orientations was handed to the parents. At the end of the session, the parents were requested to summarize all the meetings in a single feeling. Father 1 used *satisfactory* and Mother 2 used *hope*.

4. Discussion

The application of the booklet "Children with Developmental Coordination Disorder: At Home, at School and in the Community" along with workshops discussed themes central to DCD such as: symptom identification, a sampling by parents of the difficulties that their children experience in their daily lives and orientations on how to understand such difficulties to help children succeed at home and at school. The activities performed with the participants were intended to help parents understand the difficulties their children related to DCD.

During the activities, the parents identified in their children typical characteristics of DCD and related to their motor coordination, such as difficulty with academic activities, slow handwriting, and inaccurate force use as well as difficulty in their everyday life activities such as dressing, eating, leisure activities, physical play, the preference for playing alone, and frustration about failure.

Attention should be drawn to the fact that during the workshops, the focus was on the characteristics per-

ceived by the parents. It should also be highlighted that the use of the booklet together with games proved to be an important approach to working with parents on DCD. The content allows for an easy, clear, and understanding on the subject. It was possible to use it as a tool and divide it into steps to work the content in the form of workshops.

These workshops are a place for reflection and discussion of experiences that allow for the identification of the theme, combine reflection and action, and increase knowledge. It also allows the establishment of a horizontal relationship between the researcher and the participants. Simulations and activities similar to the ones faced by these children were used at the workshops, and it was possible to lead parents to reflect on the characteristics and motor and psychosocial difficulties faced by their children.

Even though the meetings were held during non-working hours, we still encountered low parent participation rates. This leads us to reflect on the need to strengthen the partnership between the school and the parents and suggests that this type of activity should be added to the activities already performed between the school and the families. The partnership between the school and families is fundamental to the success of any learning and development process. According to Fusverki & Pabis (2008), the school should open the doors to parent participation using different activities that meet their needs. On the other hand, the lack of teacher participation in the activity is worrying and can be considered one of the limitations of the study. Provide their participation in this space to clarify doubts about the DCD is a challenge for researchers.

In this study, it was possible to understand parent identification with DCD-related problems as being similar to their children's characteristics and difficulties as well as their acknowledgment of the need for more specific attention being paid to their children's academic and everyday lives. Attention should be drawn to the fact that most parents work away from the home and spend little time with their children. Nevertheless, this situation should not interfere with their participation in school activities (Fusverki & Pabis, 2008).

Parent participation in their children's school lives is even more important when the child shows some type of deficit. In the case of DCD, in which a child shows a low tolerance to frustration, low self-esteem and a lack of motivation in addition to the need to perform motor activities in a protected environment to be more confident when facing other children, the parent's presence is a determining factor (Missiuna et al., 2007).

This study presented a report of the implementation of strategies for understanding the DCD by a small group of parents of children aged seven years. This way, it is indicated the need to expand the study in order to apply a more detailed methodological design, with pre and post test measures that can systematize the gain of parental knowledge and changing attitudes about the disorder.

5. Conclusion

The present report aimed to describe the experience of meeting with parents of children identified with DCD in order to explain and discuss the characteristics and difficulties related to the disorder, through the educational resource "Children with Developmental Coordination Disorder: At Home, at School and in the community". Although the study was conducted with a small number of parents, it was considered that such initiatives were important ways to inform parents of lightweight way involved with the routine aspects of children with DCD and ways of dealing with the symptoms. It is recommended that future studies should extend this experience, with a wider sample.

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A Comparative Study of Physical Fitness among Egyptian and German Children Aged Between 6 and 10 Years

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Abstract

The aim of the present study was to compare the physical fitness of Egyptian (n = 403) and German (n = 1712) volunteer children aged between 6 and 10 years. The German motor test (DMT), height, weight, and body mass index (BMI) were measured. ANOVA showed that the results of the motor performance ability (MPA) were affected by the ethnicity with higher performance for German children ($p < 0.05$). German children's superiority in strength is present from the age of 6 years ($p < 0.001$ for the Push-Ups and $p < 0.05$ for the Long Jumping), to the age of 10 years ($p < 0.001$ and $p < 0.01$, respectively). However, their superiority in coordination ability was observed only in school aged children ($p < 0.05$ and $p > 0.05$, respect to 6 and 10 years old). With maturation from six to ten years, the achievement level for both populations show a positive improvement in the coordination and strength, and reduction in the flexibility ($p < 0.001$), with a higher rate of increase for the German children, except boys in the Push-Ups. Therefore, more strength-oriented physical activities before the age of 6 years and coordination-oriented activities between 6 and 8 years are recommended for Egyptian PE curriculum.

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Keywords

Motor Development, Physical Fitness, Anthropometric Parameters, PE Curriculum

1. Introduction

Current research has established that a lack of exercise and a sedentary lifestyle plays a central role in many health problems. Increasing physical and motor activities have been shown to positively influence the achievement level of motor development, which in turn positively influences the general development of children (Kambas et al., 2004; Ketelhut et al., 2005; Krombholz, 2005; Kunz, 1993; Rethorst, 2004). In this context, taking the motor performance ability (MPA) as an evident indicator of the children's physical fitness and motor development level, Booth et al. (1997) shows that children who have better MPA are more physically active and less likely to be sedentary than those with poorer MPA. They also suggest that potential MPA to target in children should include activities, such as running, speed, agility, jumping, balance, and visual motor skills.

Likewise, the interactive effects between MPA and health development, as well as possible genetic differences, have become some of the most important scientific fields to define the expected disease which may be related to later growth and development (Gallahue & Ozmun, 2006). The link between MPA, health and growth development has only been researched and observed in developed countries (i.e. studies by Kuntzleman et al. (1992) in USA, Craig et al. (1994) in Canada, Booth et al. (1997) and Tomkinson (2004) in Australia, and Bös & Scheid (1994) and Bös (2003) in Germany). Recently, this link was affirmed and well established in the study conducted by Stodden et al. (2008).

In Egypt the majority of related studies have concentrated on studying physical activities and health (Alwasif, 2001), but not how it relates to MPA. Hassan (2003) evaluated the conditional abilities by the talented children. In another study, Elbatrawy (2008) looked at the development of MPA of children with mental disability during free time activities. Studies that focused on the level of MPA by typically developed children at primary school age have rarely been implemented in the Egyptian environment (Abdel Karim, 2013). Therefore, given the lack of studies in this field in Egypt and based on the idea of Kelly (2010) who believes that addressing the physical and motor needs of children (regarding age and gender factors) is one of the most important requirements for the development of PE curriculum, the first objective of the present study was to evaluate the anthropometric parameters (i.e. Height, Weight and BMI) and the MPA (i.e. coordination, strength and flexibility) of Egyptian children (i.e. boys and girls) aged from 6 to 10 years old.

Additionally, although as a general rule the stages of motor development are the same for all children worldwide, there are developmental differences in the rate of motor development dependent on the special characteristics of the environmental conditions in which children grow (Barros et al., 2003; Giagazoglou et al., 2007). Comparative studies are implemented to improve knowledge and recognize and identify differences in order to learn from other orientations and suggest solutions (OECD, 2001). Despite the evidence showing a need for cross cultural fitness studies, Germany has been involved in only a limited number of these studies (Wagner et al., 2009).

Supported by previous studies, researchers from the present study believe that comparing fitness development between German and Egyptian children should be considered. The presented comparison could be a step forward in developing a primary level PE curriculum for both countries. Additionally, this comparison could be used to compare with the results of a similar study by Hardman (2009), who defined differences between Middle East and European countries in achieving gender equality in PE (i.e. 33% and 94%, respectively). The second objective of this study is to measure the difference of anthropometric parameters and MPA among children of primary school in Egypt and Germany according to age (6 - 10 years old) and gender. It should be noted that the choice of the age period is based on the results of Bös & Ulmer (2003) who suggest that this age sequence (6 - 10 years old) is very important in the development of the children reaching basic levels of motor development for the age of 9 or 10.

2. Method

2.1. Participants and Setting

Participants were primary school aged-children ranging in age from 6 to 10 years. The participant pool included

children from Germany (n = 1712); from the MoMo study (4529 randomly selected children; Bös, 2009; Wagner et al., 2013) and Egypt (n = 403). The selection of participating Egyptian schools was based on age, socioeconomic level, and demographic characteristics. Thirteen primary schools representing a lower, medium, and higher socioeconomic status were chosen. According to Helsinki Declaration, participation was voluntary and informed written consent was obtained from the school directors, participants and their parents or guardians before the children entered into the study.

The measurement was carefully supervised inside the school gym by observers trained in anthropometric and motor techniques with respect to the WHO recommendations for the anthropometric tests and to the German Nationwide Survey (KiGGS) for the motor tests. A well-tested design and calibrated equipment at frequent intervals were used.

Height was measured in a standing position, without shoes, to the nearest 0.1 cm using portable gauges (Seca, Germany). The weight was performed with minimal clothing and recorded to the nearest 0.1 kg using electronic scales (Teraillon, France). Body mass index (BMI) was calculated using the software of The German motor test (DMT). The DMT was administered in a group setting during regular school classes. The measurements were conducted in sessions lasting about 90 min. Testing sessions included 20 children participants at a time. Five assistant researchers assisted in administering the testing.

2.2. Test Description

The German motor test (DMT) is targeted of the children ages of 6 - 18 years (Bös, 2009). This test is used to assess motor abilities including endurance, strength, speed, coordination, and flexibility which are used together to indicate the general MPA (Bös, 1987). Assessing the motor abilities of the DMT is achieved through structured motor skills like running, jumping, and balancing. Sport-specific skills are excluded in this testing. In the current study the test items measuring the coordination (i.e. balancing backwards (BB), jumping sideways (JS)), Strength (i.e. push-ups (PU), long jumping (LJ)) and flexibility (i.e. stand and reach (SR)) were used.

2.3. Validity and Reliability

The content-related validity of all tests was evaluated to be reliable with regard to significance and feasibility as based on expert ratings. The test development, used in this study, was based on an international expert questionnaire involving 40 selected fitness experts in 25 European countries who were asked about the relevance of the test contents and requirements in sport-motoric tests regarding the documentation of MPA (Bös, 1992). To determine test-retest reliability for the Egyptian sample, the motor tests were performed twice within 2weeks on the same children, applying the same test situation and the same study investigators. There was a good test-retest reliability coefficients ($r_{min} = 0.68$ to $r_{max} = 0.94$).

2.4. Data Analysis

All statistical tests were processed using STATISTICA Software (Stat-Soft, France). Following normality confirmation using the Shapiro-Wilks W-test, anthropometric parameters, and motor performance, data were analyzed using a three-way ANOVA (2 levels [countries] × 2 levels [gender] × 5 levels [age]). Post hoc tests were conducted when significant main effects were found using Fisher's least significant difference (LSD). Effect sizes were calculated as partial eta-squared ($\eta^2 p$) to assess the practical significance of our findings. Significance was set at $p < 0.05$.

3. Results

Statistical analysis (**Figure 1**) showed a significant effect, in regards to countries, for the anthropometric parameters (i.e. Height ($F = 4.5$, $p < 0.05$, $\eta^2 p = 0.14$), Weight ($F = 16.88$, $p < 0.001$, $\eta^2 p = 0.38$) and BMI ($F = 12.5$, $p < 0.01$, $\eta^2 p = 0.32$) with higher values of the Height for the German children and higher values of the Weight and BMI for the Egyptian children. Similarly, there was a significant effect in the intra-group differences, with higher values of height ($p < 0.05$) for both German boys and girls compared to their Egyptian peers. Higher values of weight ($p < 0.01$ and $p < 0.05$) and BMI ($p < 0.001$ and $p < 0.05$) respectively for Egyptian boys and girls compared to their German peers was observed. Concerning the effect of the gender in the anthropometric children's parameters, statistical analysis showed no significant difference between total boys and girls tested in either

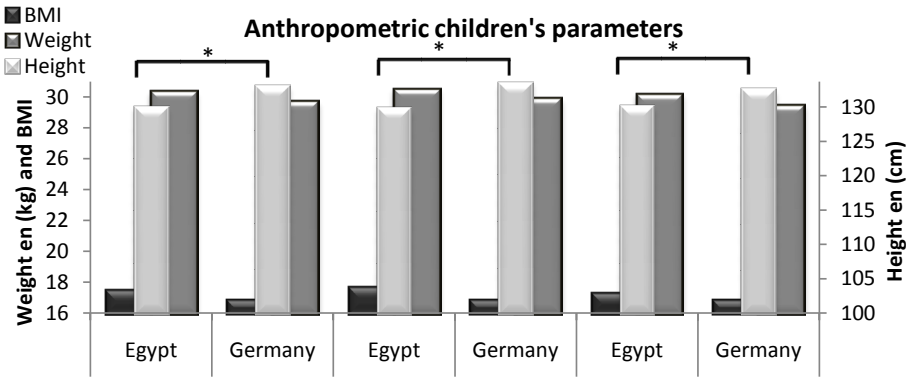

Figure 1. Anthropometric children's parameters among Egyptian and German populations. * represents significant difference between Country in the anthropometric parameters (i.e. Height in (cm), Weight in (kg) and BMI with $p < 0.05$. Values are represented as mean ± SE.

participating country ($p > 0.05$). Additionally for these variables, there were no significant interactions between countries and gender ($p > 0.05$).

Mean values of the different DMT tests among Egyptian and German children are shown in **Table 1**. Both countries and gender effect were significant (F = 79.8, $p < 0.001$ and F = 20.82, $p < 0.01$ respectively) with a better performance for the German than the Egyptian children in the majority of tested abilities ($p < 0.05$ for JS and SR and $p < 0.001$for LJ and PU) and a better performance for the boys than girls in the strength tests ($p < 0.001$ and $p < 0.05$ respectively for LJ and PU). However, girls performed better in the BB and SR tests ($p < 0.05$). Concerning the gender intra-group differences, boys in Egypt have a higher performance than girls in the strength exercises ($p < 0.001$ and $p < 0.01$, respectively for LJ and PU tests) and jumping sideways exercise ($p < 0.01$). However, non-significant difference has been shown for the (BB) and (SR) tests ($p > 0.05$). On the other hand, German girls show better motor performance ability in the majority of tests (i.e. BB, JS and SR with $p < 0.05$, $p < 0.05$ and $p < 0.01$ respectively). Boys performed better only in the LJ test ($p < 0.01$).

Regarding the countries intra-group differences, German boys and girls show higher MPA than their Egyptian counterparts; (i.e. BB, LJ and PU respectful to boys ($p < 0.05$, $p < 0.001$ and $p < 0.05$ respectively), and BB, JS, LJ, PU and SR respectful to girls ($p < 0.01$ for BB, JS and SR and $p < 0.001$ for LJ and PU).

An overview of the MPA (**Table 1**) shows the existence of interaction ($p < 0.01$) between countries and gender (F = 32.85, F = 40.19, F = 28.59 and F = 34.95 for JS, LJ, PU and SR respectively).

Figures 2-4 show the development of the MPA tests among Egyptian and German children (i.e., BB, JS, PU, LJ and SR) from the age of 6 years old to the age of 10 years old. As these figures indicate, all tests were affected by age (with F = 12.04, $p < 0.001$, $\eta^2 p = 0.32$; F = 67.09, $p < 0.001$, $\eta^2 p = 0.74$; F = 37.95, $p < 0.001$, $\eta^2 p = 0.58$; F = 21.92, $p < 0.001$, $\eta^2 p = 0.50$ and F = 13.09, $p < 0.001$, $\eta^2 p = 0.36$ respectively for the BB, JS, LJ, PU and SR).

Concerning the coordination ability (**Figure 2**), statistical analysis shows that at age 6 Egyptian children had higher performance levels (F = 5.42, $p < 0.05$, $\eta^2 p = 0.15$) than German children in the Balance test (i.e. for boys as well as girls $p < 0.05$). JS test results showed no significant difference at age 10; the performance results were inversed with higher values for the German children in both tests (F = 11.78, $p < 0.01$, $\eta^2 p = 0.23$ for the BB test and F = 4.43, $p < 0.05$, $\eta^2 p = 0.10$ for the SJ test. From age 6 to 10 German children (i.e. boys and girls) showed improvement in their coordination abilities in both tests ($p < 0.001$; 55.24% ± 4.11% and 46.20% ± 4.12% for BB test and 72.27% ± 7.98% and 66.95% ± 7.86% for JS test). However, a significant improvement was registered only for the JS test for Egyptian children ($p < 0.001$), with a lower rate of increase ($p < 0.01$) than their German peers (62.92 ± 7.65 and 44.44% ± 7.93% respective to Egyptian children JS test).

A more in depth look, using age 8 as a middle age in our sample, showed a significant improvement for the German samples (i.e. boys and girls) in both the age range before and after the median age (i.e. 6 - 8 and 8 - 10 years old) in the coordination abilities ($p < 0.001$). The improvement level observed among the German children was not observed for the Egyptian sample in most instances. In fact, no significant improvement was shown during the 6 - 8 age period for girls in the BB test and for boys in the JS test. Similarly, no significance was shown during the 8 - 10 age period for both gender in BB test and for girls in the JS test ($p > 0.05$). For both

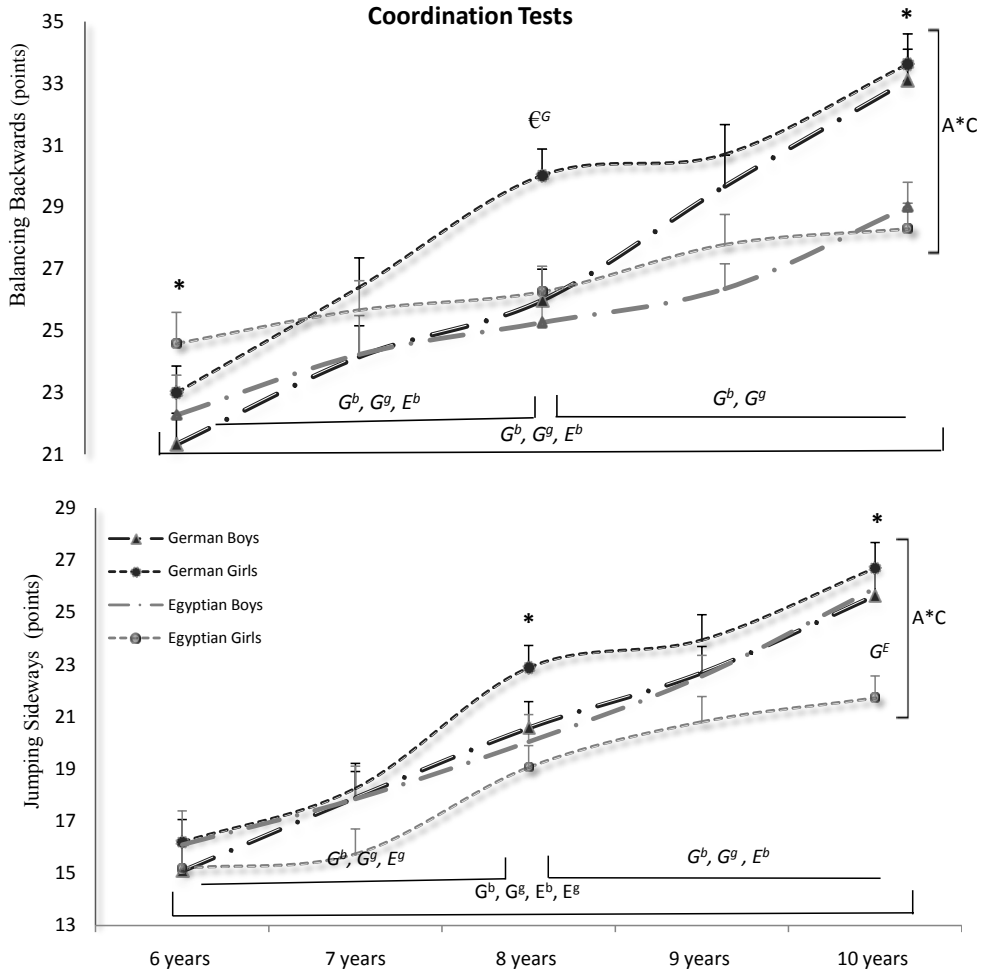

Figure 2. Coordination abilities (i.e. BB and JS) of Egyptian and German boys and girls among different age**.** A*C indicates significant interaction age x country with $p < 0.001$. $€^G$ and $€^E$ indicate significant effect of the Gender respectively in the German and Egyptian children's abilities ($p < 0.05$). * indicates significant effect of the country ($p < 0.05$). G^b, G^g, E^b and E^g Indicate significant improvement in the tested ability respect to the German boys and girls and Egyptian boys and girls ($p < 0.05$).

tests of coordination abilities a significant interaction regards to age × countries was shown ($F = 4.99$, $p < 0.01$, $\eta^2 p = 0.16$ and $F = 5.24$, $p < 0.001$, respectively for BB and JS).

Regarding strength ability (**Figure 3**), statistical analysis show that at age 6 German children (i.e., boys and girls) had higher performance in both LJ and PU tests than the Egyptian children ($F = 18.35$, $p < 0.001$, $\eta^2 p = 0.37$ and $F = 3.54$, $p < 0.05$, $\eta^2 p = 0.18$, respectively). The exception was for boys in the PU test; the superiority in LJ and PU persist and increase until age of 10 in both tests ($F = 59.18$, $p < 0.001$ and $F = 8.96$, $p < 0.01$, respectively) especially for girls.

Concerning gender difference, the LJ test showed a significant difference for the German population in the 10 year age level ($p < 0.01$) but not at the 6 year age level; while the Egyptian sample showed significant difference from the entire age range (6 - 10 years old) ($p < 0.01$). In the PU test, no significant difference was found between German boys and girls. However, in the Egyptian children, it was present from age 6 ($p < 0.01$) through age 10 ($p < 0.001$). Results showed significant improvement of strength performance from age 6 to age 10 ($p < 0.001$) especially for boys (rates of increase: 25.15% ± 4.50%, 21.10% ± 3.36%, 28.50% ± 4.11% and 25.49% ± 3.63% in the LJ test and 79.34% ± 6.74%, 42.12% ± 7.74%, 50.73% ± 6.61% and 38.62% ± 7.73% in the PU test, respective tor Egyptian boys and girls as well as German boys and girls).

Additionally, from age 6 to 8 no significant improvement was shown for the Egyptian girls in both tests ($p > 0.05$) and similar results were shown for the German girls in the 8 - 10 age period. For the LJ test, a significant

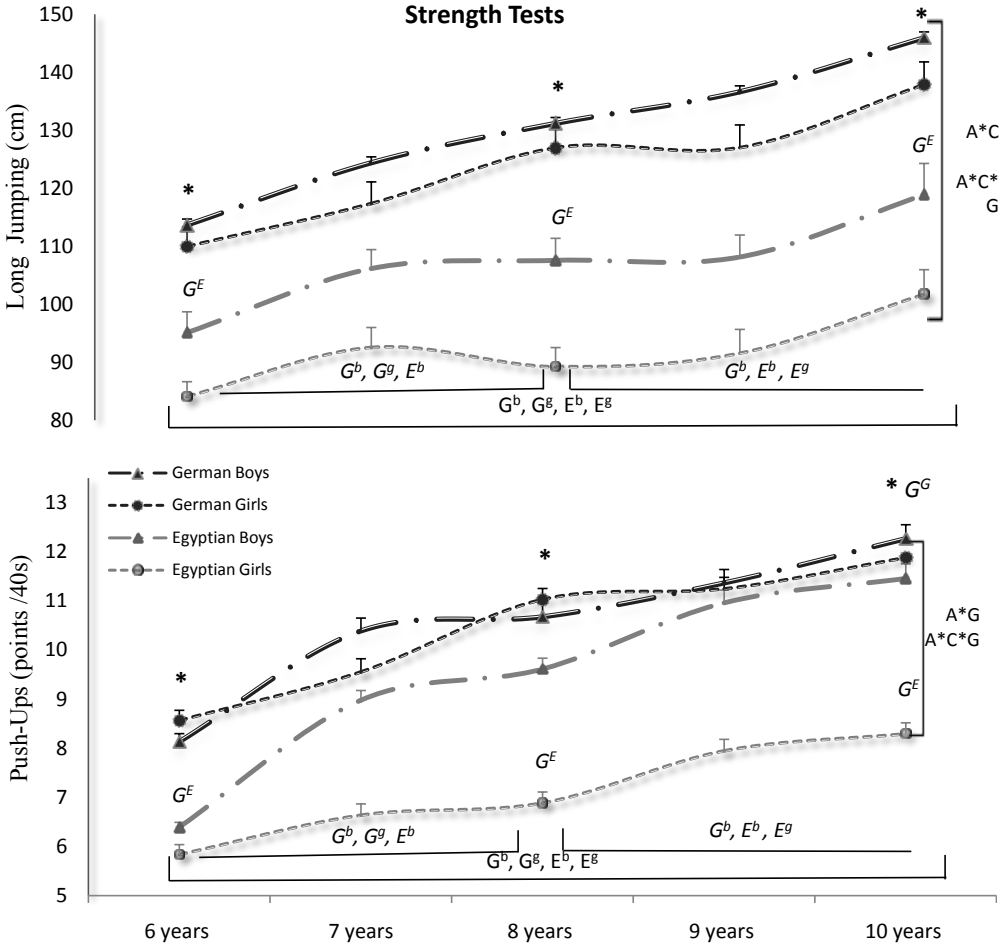

Figure 3. Strength abilities (i.e. LJ and PU) of Egyptian and German boys and girls among different age. A*C, A*G and A*C*G indicate respectively significant interaction age × country ($p < 0.001$), age × gender and age × country × gender ($p < 0.05$). €^{G} and €^{E} indicate significant effect of the Gender respectively in the German and Egyptian children's abilities ($p < 0.05$). * indicates significant effect of the country ($p < 0.05$). G^b, G^g, E^b and E^g indicate significant improvement in the tested ability respect to the German boys and girls and Egyptian boys and girls ($p < 0.05$).

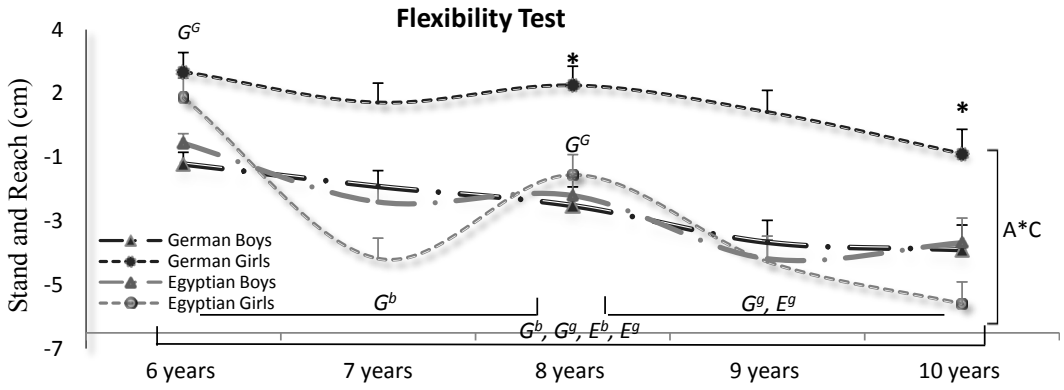

Figure 4. Flexibility abilities (i.e. Stand and Reach) of Egyptian and German boys and girls among different age. A*C indicates significant interaction age × country with $p < 0.01$. €^{G} and €^{E} indicate significant effect of the Gender respectively in the German and Egyptian children's abilities ($p < 0.05$). * indicates significant effect of the country ($p < 0.05$). G^b, G^g, E^b and E^g indicate significant improvement in the tested ability respect to the German boys and girls and Egyptian boys and girls ($p < 0.05$).

Table 1. MPA characteristics of Egyptian and German boys and girls (age between 6 and 10 years old).

	Egypt			Germany			Egy + Ger		ANOVA		
Variables	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Country	Gender	Interaction
BB (points)	25.42* ± 5.40	26.5* ± 4.83	25.97 ± 5.11	26.85*€ ± 4.12	28.76*€ ± 4.10	27.80 ± 4.11	26.14€ ± 4.76	27.64€ ± 4.46	$F_{(1,4)} = 3.05$, $p > 0.05$, $\eta^2p = 0.43$	$F_{(1,4)} = 11.23$, $p < 0,05$, $\eta^2p = 0.74$	$F_{(1,4)} = 1.47$ $p > 0.05$, $\eta^2p = 0.27$
JS (points)	20.00€ ± 2.56	18.02*€ ± 2.46	19.0* ± 2.51	19.89€ ± 2.40	21.10*€ ± 2.40	20.4* ± 2.40	19.94 ± 2.48	19.56 ± 2.43	$F_{(1,4)} = 12.69$, $p < 0.05$, $\eta^2p = 0.76$	$F_{(1,4)} = 0.98$, $p > 0.05$, $\eta^2p = 0.20$	$F_{(1,4)} = 32.85$, $p < 0.01$, $\eta^2p = 0.89$
LJ (cm)	106.6*€ ± 8.90	91.3* € ± 7.84	98.9* ± 8.37	129.9*€ ± 8.73	123.3*€ ± 8.21	126.6* ± 8.47	118.2€ ± 8.82	107.3€ ± 8.03	$F_{(1,4)} = 138.6$ $p < 0.001$, $\eta^2p = 0.97$	$F_{(1,4)} = 114.3$ $p < 0.001$, $\eta^2p = 0.97$	$F_{(1,4)} = 40.19$ $p < 0.01$, $\eta^2p = 0.91$
PU (pts/40 s)	9.48*€ ± 1.66	7.13*€ ± 1.45	8.30* ± 1.56	10.57* ± 1.48	10.46* ± 1.47	10.51* ± 1.48	10.03€ ± 1.57	8.79€ ± 1.46	$F_{(1,4)} = 347.6$ $p < 0.001$, η^2p=0.99	$F_{(1,4)} = 16.0$, $p < 0.05$, η^2p=0.80	$F_{(1,4)} = 28.5$, $p < 0.01$, η^2p =0.88
SR (cm)	−2.10 ± 2.58	−2.44* ± 2.51	−2.28* ± 2.55	−2.14€ ± 2.90	1.44*€ ± 2.91	−0.50* ± 2.90	−2.13€ ± 2.74	−0.65€ ± 2.71	$F_{(1,4)} = 12.8$ $p < 0.05$, $\eta^2p = 0.76$	$F_{(1,4)} = 13.3$, $p < 0.05$, $\eta^2p = 0.77$	$F_{(1,4)} = 34.9$, $p < 0.01$, $\eta^2p = 0.90$
									$F_{(1,4)} = 79.8$ $p < 0.001$, $\eta^2p = 0.95$	$F_{(1,4)} = 20.8$, $p < 0.01$, $\eta^2p = 0.84$	$F_{(1,4)} = 45.4$ $p < 0.01$, $\eta^2p = 0.92$

The different results of coordination tests ((balancing backwards (BB) and jumping sideways (JS)), strength tests ((push-ups (PU) and long jumping (LJ)) and flexibility test ((stand and reach (SR)) represented as mean ± SE among boys and girls in Egypt and Germany. Significant differences between country are represented with *. Significant differences between gender are represented with "€" ($p < 0.05$).

interaction was found; countries × age ($F = 7.82$, $p < 0.001$, $\eta^2p = 0.22$) and age × gender ($F = 3.40$, $p < 0.05$, $\eta^2p = 0.13$) were observed for the PU test. Both tests showed a significant interaction age × gender × countries ($p < 0.05$, $F = 2.70$, $\eta^2p = 0.10$ and $F = 2.84$, $\eta^2p = 0.11$, respectively for LJ and PU).

In contrast to the previous result of MPA (**Figure 2** and **Figure 3**) which characterized a general improvement (i.e. BB, JS, LJ and PU), statistical analysis (**Figure 3**) showed a general performance retardation with age growth (6 - 10 years old) in the flexibility test (ST) for both populations among both genders ($F = 38.90$, $P < 0.001$, $\eta^2p = 0.56$ and $F = 38.11$, $p < 0.001$, $\eta^2p = 0.22$, respective to the Egyptian and German populations). This retardation was especially observed in 8 - 10 age range for girls in both countries ($p < 0.001$and $p < 0.01$ and in the 6 - 8 age range for German boys ($p < 0.01$). In this test a significant interaction for age × countries was shown ($F = 4.48$, $p < 0.01$, $\eta^2p = 0.16$).

4. Discussion

The present study had two purposes. The first was to evaluate the anthropometric and motor performance abilities in Egyptian children aged between 6 and 10 years old. Secondly, the study then sought, to compare the anthropometric and motor results from the Egyptian children with those of their German peers looking for differences and suggesting recommendations to improve the content of PE curriculum in both countries. For these reasons the present study assessed three factors for each tested parameter (i.e., difference by countries, gender and age).

Statistical results showed that the country factor significantly affected the anthropometric parameters (i.e. Height, Weight and BMI) (i.e. German children were taller and Egyptian peers have higher weight and BMI). However, the gender factor shows no significant effect in the same parameters and no interaction between these two factors was found. Concerning the MPA, the factors of both countries and gender had a significant effect on children's motor ability with a better performance by the German children in comparison to their Egyptian counterparts for the majority of tested abilities (i.e. JS, PU, LJ and SR). Existence of interaction between countries and gender for these abilities was shown. With maturation (age as a factor), the achievement level for both genders in the two different countries show a positive improvement in the coordination and strength test and reduction in the flexibility test.

German children showed a stable progression and a higher rate of improvement for the majority of motor tests.

The exception was with respect to the PU test in which Egyptian boys performed better than Egyptian girls. A significant interaction between age × countries was shown for all tests except for PU in which the interaction was between age × gender. Likewise, a significant interaction age × gender × countries was shown for strength abilities.

It should be noted that the most prominent testing result differences between the German and Egyptian populations (i.e., better results for German) were predominantly observed between 6 - 10 age levels and generally centered on strength testing. The majority of other abilities, there was no difference in regard to specific age; but instead developed as children got older.

For the Egyptian children, these findings suggest deficiency (i) in physical activity before school age, (ii) in the Egyptian physical education curriculum So that some recommendations to improve physical fitness before school age as well while in school are given in the conclusion.

The results of the present study support the conclusions found in previous research which noted that the stage of motor development is not dissimilar for children on a worldwide perspective. The developmental rate is dependent on the special characteristics of the environmental conditions in which the child grows (Barros et al., 2003; Giagazoglou et al., 2007). In fact anthropometric data (i.e. height, weight and BMI) in the present study were affected only by the countries factor while gender factor has no effect. In addition, statistical analysis of the motor abilities development with respect to age show that for both counties children improve coordination and strength abilities and at the same time deteriorate their flexibility; But this change occurs with a different rate of increase which result in a significant interaction between age × countries and no significant interaction between age × gender.

Additionally, these present findings confirm the research of Bös et al. (2002) who suggests that the presence of different cultural conditions while growing up as well as physical factors such as body height, body weight and typical diseases could influence the motor development. The present findings are in line with previous research by Kretschmer (2001) & Bryan et al. (2006) who suggest that the level of MPA is culturally different and that children raised in Western cultures (e.g. German) have a better physical fitness than those growing up in non-Western cultures (e.g. Egypt).

Therefore, body composition and social cultural factors including the educational system, and the rate of physical and motor activities appear to be the most influential factors in reducing the rate of motor development by Egyptian children as compared to German children.

The other factors that could illustrate the superior assessment scores for German children over their Egyptian peers are from the social-cultural conditions which are demonstrated in the range of physical and motor activities existing in both countries. Indeed, the German children have more chances than their Egyptian peers to participate in many well-organized physical and motor activities. Moreover, the socio-cultural factors can be considered as indicators for a positive relationship between motor development and material and social factors that directly affect the possibilities and suggestions for physical activity. These include a large living area, good accessibility of play areas, sports interest of parents, movement-friendly kindergarten or school, and membership in a sports club (Breithecker, 1998; Emrich et al., 2004; Rethorst, 2004; Scheid, 1994a, 1994b).

By analyzing the difference between Egyptian and German PE curriculum, the primary reason stressed for raising the performance level of MPA might be found. MPA, which are energetically based in things such as strength and endurance, are generally absent in Egyptian PE curriculum. For instance, the Egyptian PE curriculum does not include specific activities to develop strength and endurance. This was in direct contrast to the German Children where the direct effect from MPA to strength was 0.97 (Lämmle et al., 2010). Moreover, the fundamental motor skills such as running, jumping and throwing are demonstrated as the main part of German PE curriculum in primary schools. In addition, smaller classes (compared to their Egyptian counterparts) and the large amounts of sport equipment allow the German PE teacher to involve the students in class activities in a much more appropriate and effective manner. Actually, focusing on developing sports skills related to sport performance and reducing the physical and motor activities that provide development of MPA (especially energetically based activities) were clearly at a disadvantage in the context of the Egyptian PE curriculum.

Moreover, in Germany, the variety of playgrounds—considered to be one of the most influential factors of the environment that offer suitable and appropriate places for outdoor physical and motor activities (Daniel, 2007)—can also be an explanation for the high level of motor achievement that exists by the energetic-conditional abilities (especially in long jumping) for German children over their Egyptian peers.

Regarding the differences between boys and girls in the achievement level of motor abilities; the German

population show that girls perform better in the coordination and flexibility test ($p < 0.05$) while boys prove superiority in the LJ test ($p < 0.05$). In Egypt, testing revealed very different results. Boys had superior scores in the majority of test (i.e. JS, PU and LJ) ($p < 0.05$) while no significant superiority was found in favor of the Egyptian girls ($p > 0.05$).

These findings reflect the situational gender inequality in PE practice and in Egypt. Furthermore, these results confirm previous research which indicated that the inequality between boys and girls in participating PE and sports activities in Middle East countries compared to European countries (Hardman, 2009).

5. Conclusion

Although heredity sets the limits of growth and development, environmental factors play an important role in the extent to which these limits are reached. Factors, such as nutrition, exercise, and physical and motor activity, are major considerations affecting growth and development. This is especially true in relation to the complexities of socio-cultural factors and motor development of children, which have still not been researched in great detail. Therefore, more international comparison studies investigating MPA (related to the social-culture factors) and longitudinal studies (as a future basic study) for the Egyptian environment are needed to help better understand the developmental differences.

6. Recommendations to Improve the Content of PE Curriculum in Both Countries

Results found in this current study have yielded several recommendations. An intervention program is recommended for Egyptian children focusing on retraining teachers how to install a student endurance program (Sabri et al., 2014) or a supplemental aerobic program (Regaieg et al., 2013), both of which have a significant effect on reducing body weight and BMI values. As well as, considering the gender equality in the implementation of the PE and sport activities. Furthermore, it is recommended that the Egyptian PE curriculum include more coordination exercises at the primary school age (6 - 10 years old). In addition, improvements in strength ability (Jumping, pushing,) training of Egyptian children from early age (<6 years) are needed besides considering the outdoor activities. Moreover, strength exercises for Egyptian girls age 6 - 8, for German girls age 8 - 10, and German boys age 7 - 9 are also recommended (oriented to the lower limbs for boys and whole body for girls).

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Sensitivity, Internal Consistency and Factorial Structure of the Arabic Version of OMSAT-3

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Abstract

The aim of this study was to assess the sensitivity, internal consistency and the factorial structure of an Arabic version of OMSAT-3 among Tunisian athletes. A translated version of OMSAT-3 was administrated to a total of 526 Tunisian athletes from both sexes divided on elite (n = 240) and non-elite (n = 286) and aged between 16 and 19 years. The results showed robust psychometric properties for the Arabic version of the instrument: it was sensitive according to the level of practice (8/12 subscales could discriminate the elites and non-elites athletes). Cronbach's alpha revealed a good internal consistency (α > 0.70 for all the subscales). Also, confirmatory factor analysis provides a good adjustment index and adequate factorial structure. This version in Arabic language presents acceptable psychometric proprieties to evaluate the mental skills of the athletes in Tunisia and in other Arabic countries.

Keywords

Sensitivity, Internal Consistency, Cross Cultural Validity, Factorial Analysis

1. Introduction

Throughout the two last decades, most empirical research in sport psychology has focused on the understanding and the formation of psychological skills (Gould et al., 2002; Vealey, 1994; McCaffrey & Orlick, 1989; Mahoney et al., 1987). In this perspective, a variety of psychological inventories and questionnaires have been vali-

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dated and published. These instruments are able to evaluate specific skills in a multidimensional framework.

For a long time, the problem was how to question the overall usefulness and applicability of these tools in one specific psychological skill or ability (Chartrand, Jowdy, & Danish, 1992). Related literature usually confirmed the need for assessment tools which allowed measuring a wide range of skills rather than separate components. With that in mind, early trials had attempted to develop and validate tools for multidimensional measure of psychological skills.

During many years, OMSAT (Ottawa Mental Skills Assessment Tool) was adjusted, rectified and developed assessing a range of mental skills used in the sport realm in order to distinguish and measure different psychological skills used to improve performances (Durand-Bush et al., 2001). This instrument development was a process. The original version of the Ottawa Mental Skills Assessment Tool (OMSAT) contained in its initial phase 14 skills grouped in five categories: basic skills (goal setting, commitment and belief), emotional competences (stress reaction, fear control, relaxation and energy), cognitive skills (mental imagery, mental practice, focusing and refocusing); competition skills (simulation and competition planning), and last team dynamics competences (Bota, 1993).

Bota (1993) submitted the OMSAT to statistical analysis to determine its reliability and validity. Acceptable results were found. However, its analysis has revealed that it would be more useful to have a shorter version of the questionnaire. This led to the development of the second version (OMSAT-2). In this revision, the mental skills were reduced to 12 skills and 71 items. Thus, the scale of the team dynamics was abandoned and the magnitude of the simulation was combined with the scale of the mental practice. A statistical analysis conducted by Draper, Salmela, & Durand-Bush (1995) was used to check the psychometric properties of this version. Later, as the results of the examination of the OMSAT-2, an attempt to improve was led by Durand-Bush (1995) who provided an improved version (OMSAT-3). The psychometric proprieties confirmatory factorial analysis revealed that the model required a suitable adjustment, which led to the development of a more robust version of OMSAT-3. Confirmatory analysis in the second version, which included 48 items and 12 scales of mental skills grouped under three broader conceptual components basic, psychosomatic and cognitive skills, indicated that the proposed model corresponded to the empirical data. Thus, the OMSAT-3 was able to discriminate between elite athletes and competitive level athletes in the majority of subscales. The results also showed temporal stability and acceptable internal consistency for the questionnaire. In the end, the OMSAT-3 seems to be a valid and reliable instrument to assess the entire population, that is to say, elites/non-elites, women/men and individual sport/team sport.

In this regard, we try to examine the psychometric properties of an Arabic translated version of OMSAT-3 with Tunisian athletes. Thus, we tested the sensitivity of the instrument and its internal consistency and we examined its factorial structure.

2. Methodology

2.1. Participants

A total of 526 competitive Tunisian athletes were recruited for the present study. These athletes were 105 soccer players (62 men and 43 women), 82 basketball players (44 men and 38 women), 78 volleyball players (42 men and 36 women), 65 handball players (38 men and 27 women); 102 athletes (59 men and 43 women) and 94 Martial art sports athletes (48 men and 46 women). The participants were divided into elite (n = 240) and non-elite (n = 286) athletes according to their level of performance.

Chronological ages of the participants were ranged between 12 and 19 years old.

2.2. Measurement

The third version of Ottawa Mental Skills Assessment Tool (OMSAT-3) developed by Durand-Bush et al. (2001) was translated into Arabic language then used to collect the psychometric data. This tool evaluates 12 mental skills, classified in 3 categories:

1) Basic skills (goals setting, self confidence and commitment);

2) Psychosomatic skills (stress reactions, fear control, relaxation and activation);

3) Cognitive skills (concentration, control of the distractions, imagery, mental practice and planning of the competitions).

The scores are obtained on 7 points Likert scale. The psychometric properties of this scale showed robustness of measurement for the original version and the Romaine version (Craciun et al., 2008).

2.3. Procedures

The OMSAT-3 translation committee included a professional translator, linguistics' scientist and three specialists in psychology. A procedure of reverse translation was treated to see the robustness of the adapted version as described by Hambleton (1993).

The answers were collected over a period of three weeks after a written agreement from the directors and the coaches of the clubs.

2.4. Statistical Analysis

Sensitivity, internal consistency and factorial structure of the Arabic version of OMSAT-3 were explored.

The sensitivity was checked by multivariate and univariate analysis of variance tests.

Internal consistency is checked by Cronbakh's alpha. Tabachnick & Fidell (2007) suggested a value of 0.70 of this coefficient for an acceptable internal consistency.

The factorial structure of the scale was demonstrated by a confirmatory factorial analysis (CFA) on each subscale. We exposed 7 index resulting from the confirmatory model: the Chi Square (χ^2), the degrees of freedom (df), Bentler's Comparative FIT Index (CFI), the Goodness of FIT Index (GFI), Pclose Fit Index (PCFI), Tucker-Lewis Index (TLI), and the Root Mean Square of Error Approximation (RMSEA). Hu & Bentler (1999), Bentler (1990) and Tanaka (1993) require an index of parsimony χ^2/DDL less than 2 or higher than 5 in order to accept the model. Furthermore, the values of CFI, GFI, PCFI and TLI were recommended close to 0.90, while a value of RMSEA was recommended lower than 0.50.

The statistical data management and computations of statistics were performed using SPSS version 20.0 (SPSS Inc., Chicago, IL, USA) and the confirmatory factor analysis was accomplished with SPSS Amos version 20.0 (SPSS Inc., Chicago, IL, USA).

The Multivariate normality of the data was provided by the Multivariate Kurtosis Mardia Coefficient.

3. Results

Table 1 shows the descriptive data statistics for elites and non elite athletes on OMSAT-3 subscales.

3.1. Sensitivity

Multivariate and univariate variance analysis were realized by the 12 OMSAT-3 sub-scales. The results of Multivariate variance analysis revealed that $F_{(12, 513)} = 1.88$ was significant ($p < 0.05$). The Univariate variance analysis showed that 8/12 subscales could discriminate the elites athletes and non-elites athletes: goal setting ($F_{(1, 524)} = 7.62$; $p < 0.01$), commitment ($F_{(1, 524)} = 5.20$; $p < 0.01$), stress reaction ($F_{(1, 524)} = 5.27$; $p < 0.05$); imagery ($F_{(1, 524)} = 6.87$; $p < 0.01$), mental practical ($F_{(1, 524)} = 4.63$; $p < 0.05$); control distractions ($F_{(1, 524)} = 5.26$; $p < 0.05$); planning of the competitions ($F_{(1, 524)} = 10.85$; $p < 0.01$).

3.2. Internal Consistency

Coronbach's alpha coefficients of OMSAT-3 subscales are all above 0.70: goal setting (alpha = 0.85); self confidence (alpha = 0.86); commitment (alpha = 0.86); stress reaction (alpha = 0.85); fear control (alpha = 0.81); Relaxation (alpha = 0.85); activation (alpha = 0.82); imagery (alpha = 0.77); mental practical (alpha = 0.81); Focusing (alpha = 0.77); refocusing (alpha = 0.79); and competition planning (alpha = 0.81).

3.3. Confirmatory Analysis of OMSAT-3

We carried out confirmatory factorial analysis (CFA) of the first and second order using the robust method of Maximum Likelihood estimate.

The results of the indexes resulting from the CFA reveal suitable conformity factorial structure with the ideal model (see **Table 2**).

The robustness of an item is better as much as its Factor loadings are high. Comrey & Lee (1992) suggested

Table 1. Descriptive statistics of OMSAT-3 scales for elites (n = 240) and non-elites (n = 286).

OMSAT-3 subscales	Level of practice	Means	Standard deviation
Goal setting (GS)	Elite	4.75	1.43
	Non-elites	4.4	1.47
Self confidence (SC)	Elite	4.81	1.53
	Non-elites	4.55	1.57
Commitment (CO)	Elite	5.06	1.5
	Non-elites	4.76	1.43
Stress reactions (SR)	Elite	4.76	1.57
	Non-elites	4.46	1.42
Fear control (FC)	Elite	4.86	1.4
	Non-elites	4.45	1.4
Activation (AC)	Elite	4.61	1.4
	Non-Elites	4.4	1.32
Relaxation (RLX)	Elite	4.65	1.49
	Non-elites	4.52	1.36
Imagery (IMG)	Elite	4.75	1.34
	Non-elites	4.46	1.2
Mental practice (MP)	Elite	4.66	1.37
	Non-elites	4.41	1.3
Focusing (FOC)	Elite	4.68	1.36
	Non-elites	4.46	1.3
Refocusing (RFOC)	Elite	4.54	1.43
	Non-elites	4.27	1.31
Competition planning (CP)	Elite	4.89	1.3
	Non-elites	4.52	1.21

Table 2. The first and second order adjustment of CFA of OMSAT-3.

	χ^2	DDL	χ^2/DDL	GFI	TLI	CFI	PCFI	RMSEA
First order CFA	1412	1014	1.39	0.90	0.96	0.96	0.86	0.027
Second order CFA	1514.60	1065	1.42	0.89	0.95	0.96	0.90	0.028

that a factorial weight higher than 0.71 is considered as excellent, higher than 0.63 is rated as very good, higher than 0.55 is acceptable and inferior to 0.45 is considered poor.

In the present study, the first order confirmatory factorial analysis of the 48 items of OMSAT-3 showed excellent factorial weights for 34 items, good factorial weights of 15 items and only one item has an acceptable factorial weight (the imagery sub-scale) (see **Figure 1**).

The psychometric data always has non-normal multivariate distribution. Thus we tested the multivariate normality of the data by the Mardia coefficient. The results demonstrated non-normal distribution for both elites and non-elites (Multivariate Kurtosis =179.36; z = 6.15, $p < 0.001$).

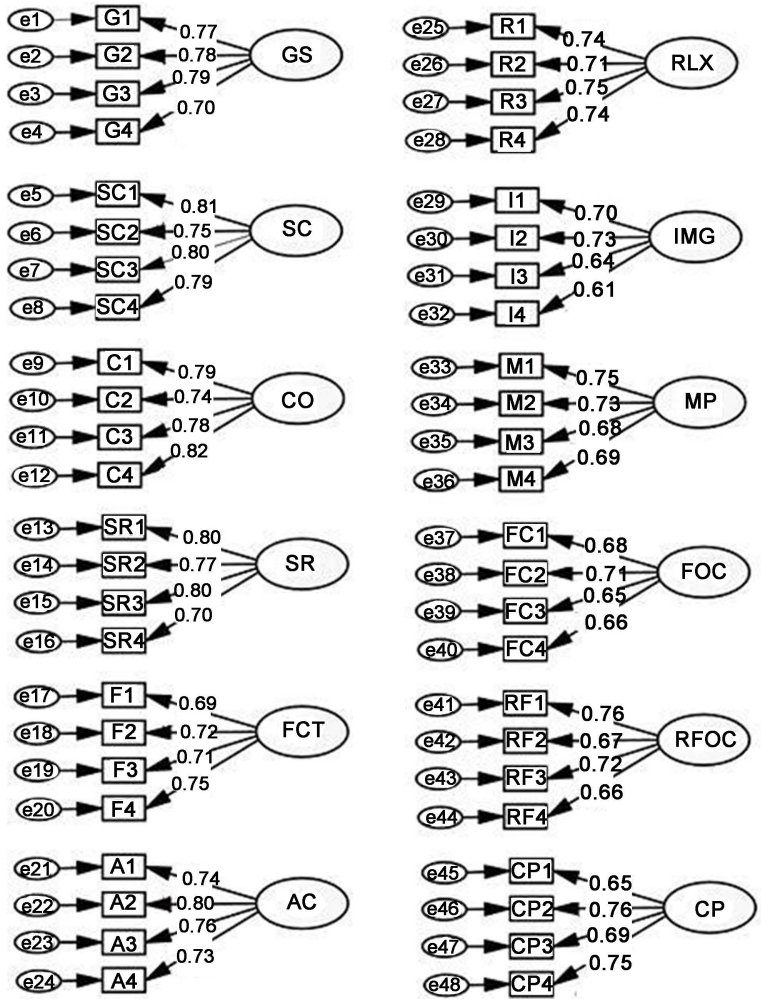

Figure 1. First order confirmatory factor analysis of the OMSAT-3 Arabic version. All parameters are significant at the 0.05 level (G1 to CP4: 48 items of OMSAT-3; e1 to e48: items errors).

The second order CFA aimed to test the ideal model elaborated from the initial version ranging the OMSAT-3 subscales in 3 categories: 1) basic skills (goal setting, self confidence and commitment); 2) psychosomatic skills (stress reaction, fear control, relaxation and activation); 3) cognitive skills (imagery, mental practice, focusing, refocusing and competition planning).

In accordance with the original version's confirmatory analysis where all hypothesized relationships were significant and of acceptable magnitude, the results of second order CFA shows that the factorial weights of the loading factors and adjustment indexes are adequate to represent the model (see **Table 1** and **Figure 2**) (Durand-Bush et al., 2001).

The correlation between the scale's components was carried out to examine whether it has excessive multicolinearity between the factors. The Pearson correlation table indicates that all correlation coefficients are lower than 0.70 (see **Table 3**).

4. Discussion

The aims of the present study were 1) to show the sensitivity and the internal consistency of the Arabic version of OMSAT-3 for elites and non elites athletes, and 2) to examine the factorial structure of Arabic translated version of the OMSAT-3 as a robust tool to evaluate mental skills in sport context. The results showed robust assessments in term of sensitivity and internal consistency similar to original instrument and cross-cultural de-

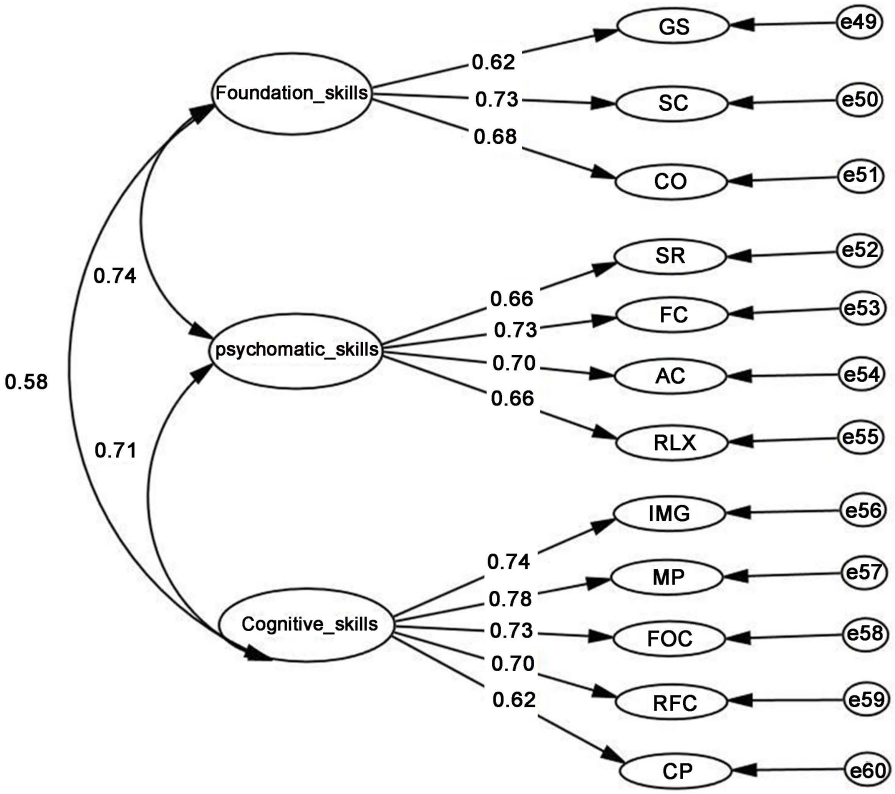

Figure 2. Second order confirmatory analysis of the OMSAT-3 Arabic version. All parameters are significant at the 0.05 level.

Table 3. Correlations Matrix of the OMSAT-3 12 scales.

	1	2	3	4	5	6	7	8	9	10	11	12
1-GS												
2-SC	0.390**											
3-CO	0.340**	0.446**										
4-SR	0.301**	0.247**	0.309**									
5-FC	0.312**	0.307**	0.319**	0.393**								
6-AC	0.245**	0.371**	0.327**	0.374**	0.403**							
7-RLX	0.230**	0.237**	0.236**	0.396**	0.368**	0.357**						
8-IMG	0.291**	0.297**	0.282**	0.296**	0.330**	0.291**	0.361**					
9-MP	0.225**	0.257**	0.228**	0.279**	0.332**	0.351**	0.363**	0.520**				
10-FOC	0.268**	0.224**	0.187**	0.252**	0.241**	0.267**	0.273**	0.333**	0.414**			
11-REF	0.251**	0.199**	0.148**	0.231**	0.239**	0.237**	0.293**	0.382**	0.402**	0.504**		
12-CP	0.177**	0.261**	0.162**	0.283**	0.247**	0.245**	0.274**	0.327**	0.326**	0.396**	0.373**	

**The correlation is significant for $p = 0.01$.

veloped tools. In addition, the first and second factor CFA revealed that the factorial structure established in Arabic language confirmed the latent model of the postulated theory.

The comparison between elite and non elite athletes was on line with various empirical studies trying to cha-

racterize the elite athletes' mental skills (Macnamara, 2013; Ghasemi, 2012). Initial work of McCaffery & Orlich (1989) and Mahonney et al. (1987) identified the mental skills leading to excellence in sport performance. Kendall et al. (1990) could highlight the effect of the mental training on the sport performance. In the two last decades, much of empirical research identified that mental skills are able to discriminate between the elite and the non-elite athletes in several sports disciplines. Similarly, Williams & Krane (2001) examined specific bibliography and could identify some psychological characteristics to justify the Olympic success: they quote high confidence, self talk, commitment, goal setting and the control strategies. One year later, Gould et al. (2002) identified commitment, the goal setting and the motivation as useful factors to discriminate the elites from the other athletes.

Other studies (for example: Durand-Bush et al., 2001, Gould et al., 1993a; 1993b) revealed that elite athletes use mental technical method like relaxation. Calmels et al. (2003) and Cumming & Hall (2002) demonstrated that elite athletes use much more the mental imagery techniques. Recent studies such as the work of Pashabadi et al. (2011), Salmela et al. (2009), Andrew et al. (2007) and Demuth et al. (2007) showed that mental skills such as motivation, stress reaction, fear control, self-confidence, relaxation, and mental effectiveness frame characterized the elite's athletes.

The results of the previous works concerning the mental skills are always linked to the social and cultural environment of the athletes.

The indexes of adjustment resulting from the CFA in the first and the second order confirmed that the Arabic version of OMSAT-3 were adequate, robust and able to represent the initial model created by Durand-Bush et al. (2001) where the 12 scales model represented relevantly the covariance within the sample. Our version seems to represent the covariance within the sample in a more satisfactory manner than the original version. Moreover, the three broader conceptual components proposed in the original version are perfectly reproduced in our Arabic version.

In this research we were incapable to validate the questionnaire on a larger population with the same ages as the original version. Also, it would be very useful to explore the mental skills deeper especially to find solutions and explanations to precocious talent abundant phenomenon. Low levels of mental skills predisposition are presented as the main causes.

5. Conclusion

This aim of this study is to evaluate the psychometric properties of a translated Arabic version of OMSAT-3 among Tunisian athletes. Good psychometric properties of this version of OMSAT-3 were shown in the present research. The factorial structure showed acceptable model of the instrument. The development of this version gives the possibility for the psychologists and the coaches in the Arabic countries to use this preliminary translation to explore the mental skills of their athletes. Nevertheless, other empirical work and varied samples are necessary to approve definitively this version.

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Participation Styles in Elementary Physical Education

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Abstract

Both observational data and direct measurement of student activity seem to indicate a large variance in student activity during physical education lessons. The aim of this study was to identify participation styles during elementary physical education lessons by using multiple data sources. A class of fifth grade students (N = 17) and a class of sixth grade students (N = 14) were taught by a physical education specialist for three lessons each. Both classes had coed physical education lessons and all students were systematically analyzed by using heart rate measurement, systematic observation and perceived exertion. Each lesson was videotaped for further analysis. Finally, six high and five low skilled students were formally interviewed after the last lesson about their experiences in physical education. The results indicated four different participation styles among the students in these physical education elementary classes. These were low skilled fighters, low skilled avoiders, high skilled fighters and high skilled avoiders. Several contextual factors are contributors to these participation styles. The main reasons for this appear to be differences in students' fitness levels, physical activity behavior and interest in physical education. This large variation among students shows that teachers need to treat each student individually.

Keywords

Physical Education, Student Physical Activity, Participation Style

1. Introduction

Several studies indicated that a large number of students had positive attitudes and experiences of physical education (Palomäki & Heikinaro-Johansson, 2011; Subramaniam & Silverman, 2007). Research conducted by Lauritsalo, Sääkslahti, & Rasku-Puttonen (2012), however, outlined some factors that determined both positive

and negative attitudes toward PE. This is nothing new. Locke (1987) argued that the real curriculum for many students was considerably different from the formal intensions of the teacher. Similarly, Dodds (1985) concluded that students learnt all sorts of things other than what the teachers intend to teach. The nature of teaching is complex and multiple variables affect student learning. Therefore, Amade-Escot & Amans-Passaga (2007) proposed that individual, activity and environmental aspects of teaching/learning were inseparable, and that content in physical education must be considered through this multidimensional perspective.

Often sport pedagogy research tends to infer that the experiences of all participants in a given instructional context are similar. This is not the case and qualitative research has described various participation styles of pupils in school physical education classes and has revealed that participants in the same instructional setting often have very different experiences. Griffin (1984; 1985) reported that hidden forces drove different subgroups to learn diverse behavior patterns in physical education classes. Within mixed-gender classes on various sports and games, Griffin (1984) noted that at the top of the girls' hierarchy were the *athletes* who were well-skilled, with high visibility and involvement. Slightly less skilled but with mixed involvement (although interested in game playing) were the *junior varsity players*. Conversely, *cheerleaders* were low-skilled players; however, they enjoyed game play and were excited when their team scored whereas the unskilled *lost souls* appeared to be passive and confused by the game. The *femme fatales* on the other hand had the skill to participate successfully, however they chose to limit their active involvement. Instead, their priorities were their appearance and attracting boys. The *system beaters* did everything possible to avoid taking part in lessons and often achieved this goal by producing excuse notes. In addition to Griffin's (1984) participations styles in girls' physical education, Fisette (2013: p. 192-193) proposed a framework of self-identified barriers to girls' engagement in and enjoyment of physical education and they were described as "*proving themselves to the boys*", "*girls are supposed to do girly things and boys are supposed to do boy-ee things*", and "*there's a risk of being embarrassed*".

Griffin (1985) also described boys' participation styles in middle school physical education and *machos* were aggressive, loud, very well skilled, and viewed by other pupils as class leaders. They teased and harassed other boys and ignored the girls. *Junior machos* aspired to be machos but had less skill and physical presence and were often resentful of skilled girls. *Nice guys* possessed intermediate to advanced skill levels but were usually supportive of girls and did not engage in verbal or physical abuse of other boys. *Invisible players*, on the other hand, were loners who were skilled at simulating participation in game play, when they were actually doing nothing of the sort. Finally, the poorly skilled *wimps* were teased and abused by other pupils and often denied the right to participate in class activities, even if they wanted to. Tischler & McCaughtry (2014) recently used the terms "*sporty*" and "*less-sporty*" to categorize boys in relation to their orientation to team sports. These students attributed levels of success to visible characteristics such as body type, fitness, degree of aggressiveness, and overall skill in sport. These factors made sporty boys stand out more positively and skillfully in comparison with less sporty boys. Content, pedagogy, and student-teacher interaction in traditional physical education led all students to perceive static and well-pronounced masculinity hierarchies. However, the students felt that the teaching of physical education was manifested differently in an adventure physical education model than what they perceived to be the case in sport-based physical education classes.

Kalaja (2012) used a quantitative approach with data from fundamental motor skill (FMS) tests and motivational and perceived competence questionnaires to categorize students. Three cluster groups of students were found in Finnish grade seven physical education classes. The first group consisted of students with low skills and low motivation and included students with low FMS, perceived competence, and self-determined motivation toward physical education. The second group comprised of students with high skills and low motivation and consisted of students with high FMS and low perceived competence and self-determined motivation toward physical education. The final category of students was the high skills/high motivation group, which included students with relatively high FMS and high perceived competence and motivation. A comparison of cluster groups with physical activity indicated that "*high skills/high motivation*" students were engaged in significantly higher self-reported engagement in leisure physical activity than the other two clusters.

Cothran (2010) combined quantitative data with students' interviews in studying underlying values and assigned meanings of high school students by quantitatively clustering similar students together. Five different groups of students were reported. One group was named "*Playful friends*" and for them physical education provided opportunities to be with friends, have fun and play, while still getting a good grade. "*Competitors*" valued skill development and the competitive phase in game play during the multi-activity approach. "*Friendly learners*" were described by the opportunity to be with friends and similarly learn and get good grades. "*Cooperative*

learners" emphasized appropriate student behavior, learning how to work together and getting good grades. Finally, the "*Social comparison*" group valued grades and their relations to other students in the class and not being embarrassed.

Both the qualitative and quantitative studies show that students are not a uniform group with all students valuing, experiencing and behaving similarly in physical education. Students experience physical education differently and those differences are often related to gender and ability. Traditional team sports are often on the basis of the multi-activity model, which rewards size and effort. The model also includes a great deal of competition and public display where low skilled or less confident students often report negative experiences and feeling of being marginalized (Smith & Goc Karp, 1996). Constantinides (2011) described the profile of obese students' experiences in physical education. These students perceived physical education to be of little or no benefit to them. They indicated a desire to become invisible during the lesson as they perceived that the activities emphasized in physical education made them feel uncomfortable in front of their classmates. Moreover, participating in traditional team sport class activities allowed their peers to publicly view their physical limitations, such as running slowly or having limited skill in a variety of activities. These obese students admitted to looking for excuses to avoid participation in physical education.

Student participation in physical education can be objectively measured by analyzing student physical activity during lessons. Several reviews (Fairclough & Stratton, 2005a, 2006; Stratton, 1996) of student physical activity have showed that students engage in moderate-to-vigorous physical activity (MVPA) about one third of physical education lesson time. This is less than the 50% recommended by Healthy People 2010. The amount of student physical activity in physical education seems to differ depending on the context, lesson content, teacher behavior, and student background variables. Student grade level is an example of one context variable, and studies show that elementary school students spend more physical education lesson time in MVPA compared with secondary school students (Fairclough & Stratton, 2005b; Gao, Hannon, & Carson, 2009; Hodges Kulinna, Martin, Lai, Kliber, & Reed, 2003; Singerland, Oomen, & Borghouts, 2011; Surapibooncha, Furney, Reardon, & Murray, 2012). Although most descriptive studies report that MVPA levels lower below 50% of lesson time, Jaakkola, Liukkonen, Laakso, & Ommundsen (2008) reported high MVPA (61%) for ninth grade students during game play, a football lesson. Additionally, Slingerland, Haerens, Cardon, & Borghouts (2014) reported a 74% and 64% MVPA level in game play for boys and girls respectively.

Alternatively, mean and maximal heart rates are other variables that can be used to evaluate activity levels. Studies have showed that average heart rate in physical education lessons ranges from 114 bpm (Laurson, Brown, Cullen, & Dennis, 2008), 132 bpm (Lyyra, Heikiaro-Johansson, Johansson, & McEvoy, 2008), 135 bpm (Sarradel et al., 2011), 142 bpm (Wydra, 2009), 140 bpm (Gao, Hannon, & Carson, 2009) and 147 bpm (Jaakkola et al., 2008) to 159 bpm (Van Acker et al., 2010).

The physical activity intensity levels similarly vary based on different content and teaching styles. Chow et al. (2008) reported that students engaged in high levels of MVPA in lessons focusing on tennis, distance dancing and free play activities, while table tennis and long jumping provided smaller proportions of MVPA. Several other studies (Fairclough & Stratton, 2005b; 2006) have indicated higher student activity levels in team game lessons. In the Netherlands, students engaged in more moderate to-vigorous physical activity during swimming classes (52%) than during non-swimming classes (40%) (Cardon, Verstraete, De Clercq, & De Bourdeaudhuij, 2004). During adventure education lessons, students spent less time in MVPA compared with traditional physical education lessons (Gehris, Myers, & Whitaker, 2012).

Several studies comparing boys' and girls' MVPA engagement during physical education showed higher levels of MVPA among boys when compared with girls during coeducational classes. This distinction has been noted when physical activity has been assessed using heart rate monitoring (Fairclough & Stratton, 2005b; Hodges Kulinna et al., 2003; Slingerland et al., 2014; Stratton, 1996), pedometers (Hannon & Ratliffe, 2005), accelerometry (Whipp, Dimmock, & Jackson, 2013) and direct observation (McKenzie, Marshall, Sallis, & Conway, 2000; McKenzie, Prochaska, Sallis, & LaMaster, 2004). In addition, Gutierrez & García-López (2012) observed student behavior in invasion ball games and reported that boys participated more in offensive play with the ball, while the girls displayed more off-the-task (spectator-player) behaviors.

Different forms of student ability can also affect students' physical activity levels during physical education lessons and Fairclough & Stratton (2005b) reported that high-ability students were more active than the average- and low-ability students. Similarly, Spessato, Gabbard, & Valentini (2013) measured physical activity levels of 5 - 10 years old children with pedometers and found that students with high motor competency were sig-

nificantly more active during physical education lessons than children with low and moderate motor competency. Conversely, Fairclough (2002) reported a weak relationship between aerobic capacity and MVPA in girls' high school physical education. Also students with higher perceived competence showed higher amounts of MVPA during game play in basketball (Slingerland et al., 2013). Nevertheless, Lyyra et al. (2008) found that middle school students with low leisure-time activity levels were as active during physical education lessons as students with high leisure-time activity levels. In addition, there are conflicting results in respect to student body composition. Spessato et al. (2013) found no significant correlation between BMI and MVPA, while Fairclough (2002) found that physical activity during physical education was inversely related to students' body fat percentage.

Additional studies (How, Whipp, Dimmock, & Jackson, 2013; Perlman, 2013) showed that teaching behaviors that aligned with an autonomy-supportive teaching approach could facilitate greater in-class MVPA levels. Other studies (Perlman, 2012; Wallhead, Garn, Vidoni, & Youngberg, 2013) also reported that teachers using the Sport Education Model (Siedentop, Hastie, & van der Mars, 2011) provided amotivated students with an increased opportunity to engage in higher levels of physical activity.

As research related to motivational aspects shows an effect on student activity, perceived exertion is also a factor that relates to physical activity behavior in children. Rating of perceived exertion has been suggested to be an appropriate measure of exercise intensity. It is assumed to represent many factors affecting the intensity of physical activity, such as students' psychological state and training status. Borg (1982) designed the first rating of perceived exertion (RPE) scale and it had been shown to be a simple and valid method for quantifying whole training session intensity for children and adolescents (Chen, Fan, & Moe, 2002; Pfeiffer, Pivarnik, Womack, Reeves, & Malina, 2002). Therefore, perceived exertion could provide additional understanding of students' physical activity during PE lessons and Marmeleira, CarrasqueiraAldeias, & dos Santos Medeira da Graça (2012) found that students experienced a light degree of physical exertion in physical education lessons with an average of 11.6 on the Borg scale. In addition, Wydra (2009) reported that 43% of the students perceived the physical education lesson to be at least somewhat demanding (at least level 13 of 20 on the Borg scale).

The research seems to indicate a large variation in student activity depending on student variables and context. Moreover, different ways of measuring student activity will provide additional variation in the data. Fairclough & Stratton (2005c) analyzed MVPA with observation and heart rate measurement and found that student activity differed markedly, with heart rate measurement showing higher values than observational data. On the other hand, Marmeleira, CarrasqueiraAldeias, & dos Santos Medeira da Graça (2012) reported that both the number of steps and the rate of perceived exertion were correlated with heart rate measurements of students' during physical activity. The inconsistence between different physical activity measures and context specificity highlights the advantage of combining instruments when assessing students' physical activity. Researchers (Fairclough, 2002; Lyyra et al., 2008) have suggested that different objective measurements and student self-reports will be beneficial in order to acquire a deeper understanding of student physical activity in physical education lessons. In addition, studies reviewed in this paper generally report physical activity as a class or group mean. Moreover, in identifying different student groups researchers have relied on qualitative observations, student interviews, questionnaires, and skill tests. Therefore, the aim of this study was to identify and understand participation styles during elementary physical education lessons by using multiple data sources to analyze student activity.

2. Methods

A physical education specialist taught two classes, a fifth grade class with 17 students and a sixth grade class with 14 students, for three lessons each. The male teacher, with a master's degree, had six years of full time teaching experience and had been employed at this elementary school for the last five years. This teacher taught with a direct-instruction style and actively supervised his students. This public elementary school (Grades 1 - 6) served 100 students from predominantly middle socioeconomic status neighborhoods.

Both physical education classes were coeducational and did not share the activity space with any other classes. The data collection took place during an indoor multi-activity unit (ballgames, fitness) in a gym with about 400 m^2 available space. Each lesson lasted from 39 to 48 minutes with generally 10% of the time allocated for pre and post management and the remaining time for skill instruction, circuit training, station teaching and game play. The first lesson for both groups consisted of a short aerobics warm-up followed by circuit training. Subsequent lessons for both classes consisted of skill practice and game play, in team handball for the fifth grade class and basketball for the sixth grade class. The teacher was instructed to teach the lessons as he normally would.

He was asked to not place any unusual emphasis on tasks that would increase heart rates more than normal (e.g., fitness work or circuit training), unless the lesson would normally have included those types of activities.

Heart rate measurement, systematic observation and perceived exertion were systematically analyzed from all students. Each lesson was videotaped with two cameras for further analysis and lesson time spent in MVPA were determined for each student. Seventy-nine individual calculations of physical activity were conducted during six physical education lessons. The study was explained and written informed parental consent was obtained prior to collecting data.

Heart rate (HR) telemetry has been shown to be a valid and reliable measurement of physical activity and has commonly been used in physical activity and physical education settings (Bar-Or, Bar-Or, Waters, Hirji, & Russell, 1996; Treiber et al., 1989). Student heart rate levels during each PE-lesson were measured with Polar Team System heart-rate monitors, developed by Polar Electro, Finland. After students changed clothes and immediately before they entered the gymnasium, they were fitted with the heart rate telemeters. Heart rate was recorded every five seconds. The heart rate telemeters were removed at the end of the lessons. The HR data was downloaded to a portable PC using the specific software (Polar Advantage TM Polar Electro, Kempele, Finland) and subsequently analyzed.

Average heart rate, maximal heart rate and MVPA (Moderate to Vigorous Physical Activity) for each lesson were derived from the heart rate measurement. The percentage of lesson time in the category MVPA for each subject was calculated. The MVPA level represents moderate physical activity, which is the minimal intensity, required to reach the recommended level volume of health-related activity. The heart rate cut point for MVPA was 140 bpm for both boys and girls and was based on values in previous research (Armstrong & Bray, 1991; Armstrong, McManus, Welsman, & Kirby, 1996).

System for Observing Fitness Instruction Time (SOFIT) was used to systematically observe students' level of MVPA. Lesson context, teacher promotion, and student physical activity levels can be analyzed with SOFIT. Validity of the activity level behaviors categories for use with school students has been verified (Rowe, Schuldheisz, & van der Mars, 1997). However, in this study only student activity was analyzed and therefore lesson context and teacher promotion were not recorded. SOFIT is a momentary time sampling and interval recording instrument and quantifies physical activity levels on a scale from 1 to 5. Non-MVPA categories comprise lying down (1), sitting (2) and standing (3), while MVPA (4 & 5) includes behaviors that are equivalent to or more active that brisk walking and high intensity activities (VPA). Summing the proportion of lesson time spent in the walking and very active categories gives time spent in MVPA. The classification of physical activity levels was made by observing each student for five seconds and then five seconds for recording their level of active engagement level. Three students were observed during one viewing of the videotape and therefore each student was observed and recorded twice during one minute. A log of activities and coding rules was kept to provide consistency in coding. The technical descriptions of the SOFIT training manual (McKenzie, 1998) were used for observer training and data collection. Coding rules for MVPA categories of "walking" (Level 4) and "very active" (Level 5) were developed so that transitions from standing or sitting to walking or running, aerobics, actively engaged in abdominal curls, throwing balls, and running were coded as MVPA. Inter observer Agreement (IOA) check was performed by coding three different students from one lesson during the pilot study. The mean IOA percentage for students' MVPA was 96.4%.

The Borg rate of perceived exertion scale is a widely used instrument to measure perceived exertion, or exercise intensity (Chen, Fan, & Moe, 2002). Perceived exertion during the lessons was measured with the Borg RPE scale, which consists of numbered categories from 6 to 20 and verbal cues, from "very, very light" to "very, very hard". Students were familiarized with the scale before the first lesson, which included defining perceived exertion, anchoring the perceptual range, explaining the use of the scale and answering questions. All students rated the perceived exertion level and they estimated how hard they had been exercising at the end of each PE lesson.

Previous research has indicated differences in student activity patterns based on ability and gender. Consequently, we asked the physical education teacher to identify three low and three high skilled students from each class. The teacher had taught most of these students for three years and made his selection based on the students' motor skills, leisure activities, and interest and attitude towards physical education in school. Only two low skilled students in grade six received parental consent to participate in the study, therefore the total sample was 11 students, with six boys and five girls.

In addition to quantitative physical activity data from all students, the sub sample of subjects (N = 11) categorized as either low or high skilled, participated in individual stimulated recall interviews after the third lesson. In

the semi-structured interview, these students could see the printouts of their heart rate curve for each lesson while we also described the content and the structure of the lesson. Each interview with these students started with general and personal questions related to their leisure time and their perception of school physical education. The main focus of the interview was related to the students' perception of physical activity and their own effort during these physical education lessons.

All data were analyzed using SPSS for Windows (21.0). Means and standard deviations were calculated for each of the variables. As interview data were collected, two researchers transcribed all the interviews. After the first print version, the interviews were replayed in order to negate transcription errors. The first, second, and third authors first read several times through the interview transcripts to gain a broad overview of the material and thereby looking for trends and explanations. The analysis was data-driven and the descriptions were condensed from the data-base by using inductive constant comparison to describe these students.

Several strategies were used to show research trustworthiness and credibility (Guba & Lincoln, 1989). Memos and notes were used to keep track of the data analysis which increased the confirmability of the study. Verbatim quotes from the students were taken in order to stay close to the data. For the result texts, we chose the most representative of the selected transcripts. Peer review and debriefing across researchers was conducted to assure credibility across findings. The peer debriefing process involved the researchers challenging each other's interpretation of the evidence.

The initial analysis of physical activity data showed a large variation between individual students and different lessons. Based on the physical activity measurements from all eleven students, we noted seven students with diverse values compared to other students in their class during these three lessons. We identified four different participation styles. These students' physical activity measurement showed either a higher level or a lower level in several data types compared to the rest of the students in the physical education lessons (see **Table 1**). These four participation styles will be described in depth in the result section.

Table 1. High and low skilled students' heart rate measurements.

Student	Lesson one#					Lesson two#					Lesson three#				
*	Mean	Max	Hr %	Sofit	Borg	Mean	Max	Hr %	Sofit	Borg	Mean	Max	Hr %	Sofit	Borg
Low skilled fighter															
Fred	142	205	56.2	50	14			absent			148	193	70.2	49	16
Tim	138	180	54.1	53	13	127	160	21.6	29	12	144	182	63.9	43	12
Other	125	187	30.7	42.2	13.4	123	182	25.4	35.5	11.9	139	182	53.8	49.6	13.5
Low skilled avoider															
Julia	114	177	24.8	35	16	96	123	0.0	33	14	102	149	1.9	36	13
Other	121	186	23.5	34.3	14.1	131	175	36.0	44.7	14.0	136	189	42.2	42.5	13.2
High skilled fighter															
Lisa	110	170	11.8	41	12	116	185	22.8	35	12	142	180	63.5	61	13
Jakob	126	191	28.1	49	9	131	189	31.5	35	11	137	180	47.3	65	13
Other	129	189	37.1	43.4	12.9	123	180	24.8	35.1	12.0	140	183	55.7	46.8	13.6
High skilled avoider															
Ben	114	187	17.2	43	11	110	176	9.9	36	11	137	180	53.2	71	15
Other	128	188	35.9	43.7	12.7	124	181	26.3	35.0	12.0	140	183	55.7	47.4	13.4
Kati	112	186	18.7	37	14	115	147	2.5	45	14	98	154	1.9	40	9
Other	121	185	24.0	34.1	14.3	130	172	35.7	43.5	14.0	136	189	42.2	42.2	13.5
Total	124	186	29.0	39.0	13.4	125	176	28.5	38.8	13.0	137	184	47.5	45.6	13.4
St De	11.5	10.7	14.2	6.7	2.0	12.5	20.9	17.3	8.7	1.3	13.7	13.9	19.3	6.5	2.2

Note: *Other = all other students in the same class; #Mean = mean heart rate; Max = maximal heart rate; Hr% = active lesson time in MVPA based on heart rate measurement (%); Sofit = System for Observing Fitness Instruction Time (%); Borg = Borg rate of perceived exertion.

3. Results

We identified four different participation styles among the students in these physical education elementary classes from the quantitative data. Students were categorized as low skilled fighters, low skilled avoiders, high skilled fighters, and high skilled avoiders. Each individual student's value varied between different lessons, which also are shown in the variation in standard deviation between different measurements. The SOFIT value showed low variation and MVPA heart rate showed high variation, although these actually measure the same aspect of physical activity during physical education lessons.

A ***low skilled fighter*** was defined as a student who tries to be physically active despite a limited ability. This category consisted of two boys from grade five. Fred and Tim showed high average heart rates and a high MVPA heart rate percentage compared to the other students while the SOFIT value was about the same or somewhat lower than the other students. Their perceived exertion was higher than other students.

Both subjects are not involved in sport and spend most of their leisure time indoors. Fred said "I have a scrap car that I usually build on behind the house. And then I tend to sit at the computer the rest of the time". Physical education is not their favorite school subject although they have a positive attitude.

Enjoyment was reflected from student skill level and success in participation. Fred stated, "I get head ache from skating. I am poor at skating and I usually fall at least five times" and "Team handball is not so fun, because I'm so short that I can't really take the ball from people". The most fun activity is dodge ball when Fred said "I usually don't get hit, while I'm so small" and Tim liked dodge and basketball because "I'm rather good at it".

Both students told that the first lesson was hard and that circuit training was the most demanding activity during these lessons. Fred had high heart rate and Borg values during this lesson, nevertheless he stated "I did rather well and it was a little bit heavy" and that "I took it easier during the second lap, while I already was tired". This shows that the sense of effort and exhaustion is rather individual and both boys also mentioned that they sometimes avoid making maximal effort, as Tim reflected "I usually take it somewhat easy".

They still participated as well as they could and they didn't give up easily even if the exercises were demanding. Fred said "I was really exhausted afterwards" and Tim noted "it was supposed to go fast and you never got to rest". However, these students indicated that they didn't like the feeling of physical exhaustion. It seemed to be typical for these students that they forgot this unpleasant feeling when they had activities that the liked. And when the activity was less fun the focus shifted towards how physically demanding it was, which was noticed by Tim "You might not think of it then. I don't think so much on the heavy [drills] as it is fun".

A ***low skilled avoider*** was identified as a student who uses minimal effort. One girl from grade six was categorized as a low skilled avoider. During the first lesson with teacher lead fitness circuit training, Julia's heart rate and SOFIT values were close to the other students while rate of perceived exertion was higher. However, during the second and third lesson, her observed (SOFIT) physical activity was lower than other students and her heart rate measurements indicated a very low effort. Julia had zero percentage MVPA although she was observed being active during the second lesson.

Julia had previously participated in a cross country ski club but at the moment was training and taking care of horses four times a week. She was aware and pointed out the importance of being active during physical education lessons. However, she admitted that she could have tried harder during the PE lessons as she said "I could have showed more effort". She came up with excuses why her physical activity had been so low for general participation in physical education "Usually I have had a cold or not slept enough and having a headache, usually we have PE at the end of the day". Julia described that she is more active out-doors where there is more space to move around compared to the gym. She also described excuses for low participation in specific lessons, as this quote about the first lesson "I was not warmed up the first lap. So then I was stiff. During the second lap one was perhaps tired from the first. I tried at least during both laps".

Julia's favorite activities in physical education lessons were different ball games but she said "if the ball was close by, I took it but I did not run and get it if someone was close [to the ball]". During game play she also noticed that "perhaps we, without noticing it, let other [students] play more" and "sometimes one notice that one stands still without thinking about it". The strategy she used when something became demanding was to slow down the pace.

A ***high skilled fighter*** shows high effort and is active. This category consisted of Jakob and Lisa from grade five. The SOFIT analysis showed high values although their average heart rate was not high. The heart rate MVPA was high except for Lisa during the first lesson and the students showed a relatively high maximal heart

rate during the lessons although the perceived exertion was low.

Both students were members of sport clubs and trained and competed several times a week. Lisa was a skier and Jakob played soccer. They had a positive attitude toward school physical education, which also was their favorite school subject. Jakob and Lisa liked both individual and team during sports physical education lessons.

These competitive students were motivated to actively participate in physical education lessons. Lisa said "I move a lot and show always high effort" and Jakob stated "I tried to be active and run all the time". In addition, Lisa stated that she saw physical education lessons as an opportunity for additional practice and to "improve the fitness". However, during the second lesson she indicated that she slowed down a little because she had a ski competition in the evening.

Both students seemed to like everything in physical education and they did not complain about anything. When asking Lisa what she enjoyed the most during these three lesson she responded that "The last one [lesson], it was the most demanding", which shows that she really wanted to be active. SOFIT data also showed that both students were very active during the third lesson. During game play they both indicated that they tried to run all the time, as Jakob stated: "I ran and jumped a lot and tried to steal the ball from the opponents, it was fun".

A ***high skilled avoider*** does not show more effort than necessary despite the high physical fitness level. Ben from grade five and Kati from grade six were identified as high skilled avoiders. These students' MVPA, average and maximal heart rate values showed generally low levels compared to other students in the class. The SOFIT observation data showed higher MVPA values than heart rate data and the perceived exertion was low.

Both students trained and competed several times a week in a ski club during their leisure time. These two students did not like everything during the physical education lessons, but Kati did like volleyball and skiing while Ben preferred team sports before individual sports. Ben and Kati admitted that they could have showed some more effort. It seemed that student performance was affected by how much fun they thought an activity was, as Kati said, "when we do fun things, I try harder. Ben also described that during the circuit training "I was tired during the second lap and at the end it was not so fun anymore". He did not enjoy this lesson and he said that "I did not become so tired" because he "did not have to run and could rest between the stations". He would not have tried harder even if the teacher would have supervised the station more actively. Kati, on the other hand, liked the circuit training because they did many different tasks and that she "really tried" and that she "did it for her own sake and that it is fun when you manage to do something".

During game play, Ben said he was running and "tries to get the ball and participate in the game". Kati, in turn, felt that she was involved but did all the time chase the ball and that "I perhaps was not really motivated". SOFIT analysis showed higher values than heart rate data for student MVPA levels, which could indicate that these students were actively participating in class activities but not pushing themselves physiologically in terms of their heart rate levels as a consequence of their high fitness levels.

4. Discussion

The aim of this study was to identify and understand participation styles during elementary physical education lesson by using multiple data sources in analyzing student activity. MVPA levels based on heart rate measurements and systematic observations from different lessons were found to be considerably lower (from 29.5% to 47.5%) than the 50% recommendation as a goal for meeting MVPA guidelines in school PE lessons. These findings are in line with several other studies (Fairclough & Stratton, 2005a, 2006; Stratton, 1996), although they are lower than MVPA guidelines. There is also a large variation between the three different lessons as well as between individual students. This considerable variance, which can be noticed particularly as high standard deviation values in heart rate MVPA data. The standard deviations of heart rate MVPA represented from 40% to 60% of the mean values, while the standard deviations for SOFIT was from 14% to 22%, which illustrates the variability of physical activity within the same construct but with different measurement. This finding provides empirical support for Slingerland (2014) conclusion that one single method of physical activity assessment is not able to capture all activity dimensions concurrently. This variation in activity levels reflects that what the teacher can see is different from the physiological response in student body.

We identified four different participation styles from our data. First, a low skilled fighter was student with limited ability, who still tries to be physically active. Low skilled fighters are not involved in sport in leisure time which can be one explanation for the low success in physical education. The students are aware of not being as skilled as the other students in the class and attribute enjoyment to success in participation, and according to

Tischler & McCaughtry (2014) they would be categorized as "less-sporty" boys. However, low skilled fighters show effort, behave well and follow the teacher's instructions, and with that respect they could be both "friendly" and "cooperative" learners (Cothran, 2010). These students showed high heart rate values for their participation, which conflicts previous studies where high skilled students were more physically active during physical education lessons than low skilled students (Fairclough & Stratton, 2005b; Slingerland, et al., 2013; Spessato, et al., 2013).

Julia was identified as a low skilled avoider and she did not use more effort than was needed. Particularly during ball game lessons, her physical activity heart rate measurements were at a very low level. Julia was not physically active during her leisure time although she spends time taking care of horses. She recognized that she was not very active during physical education lessons and she finds several different excuses for her inactivity. Such students were described by Griffin (1984) as *system beaters* and by Tousignant & Siedentop (1983) as *competent bystanders* and they do everything possible to avoid taking part in the lesson by pretending to be on task and not disturbing the class structure. This low skilled avoider would also fit in to Kalaja's (2012) first cluster group of students, namely, students with low skills, perceived competence, and self-determined motivation towards physical education. Julia's participation style can also be compared with the way Constantinides (2011) described the profile of obese students' experiences in physical education. They looked for ways to avoid participation and to become invisible, while participating in traditional team sport made them feel uncomfortable in front of their classmates. Several researchers have showed lower physical activity levels for girls than for boys (Fairclough & Stratton, 2005b; Hodges Kulinna et al., 2003; Slingerland, et al., 2013) as well as for low skilled students (Fairclough & Stratton, 2005b; Slingerland, et al., 2013; Spessato, et al., 2013). Julia was particularly inactive during game play which might be related to gender stereotypes among students during game play. Gutierrez & García-López (2012) also reported from observations of student behavior in invasion ball games that girls were more cooperative and showing off-the-task (spectator-player) behaviors while boys were active and focused more on the goal.

High skilled fighters were students that actively participated at a high level during physical education lessons. They were athletes training several times a week and physical education was their favorite school subject. The positive attitude was manifested in everything they participated in and the more challenging and demanding the activity was the more the enjoyed it. These students are typical examples of what Kalaja (2012) labelled as students with high motor skills and high perceived competence and motivation. In addition, according to Tischler & McCaughtry (2014) these students were *sporty* students, who were skilled, fit and active. Moreover, Griffin (1984) described girls as *athletes* or *junior varsity* players, who were skilled with high involvement and interested in game play. Similarly, Griffin (1985) described boys as *nice guys* when they were skilled and enjoyed the game.

The final participation style was high skilled avoiders, who despite the high physical fitness level did not show more effort than they needed to take part in the physical education lessons. Although these students were athletic, they did not exhibit the positive attitudes towards physical education that high skilled fighters did. When they did not enjoy the activity they decreased their activity level, which is similar to the second cluster group; students with high skills and low motivation (Kalaja, 2012). Griffin (1984) also described girls in physical education as *femme fatales* and they were skilled students who choose to limit their active involvement. While heart rate data for students' MVPA levels showed lower values than observational physical activity data, it could be that these students participated as the other students but due to their high physical fitness levels they physiologically didn't reach a high effort level as measured by the heart rate monitors. Another possible explanation might be that when heart rate monitoring measures the physiological load and when physical education lessons are intermittent in nature and variable in duration and intensity, high skilled and fit students may recover faster and therefore the heart rate MVPA values are lower.

Although we found a large variation in physical activity between students and lessons, we have identified four different participation styles. When comparing these participation styles with previous qualitative and quantitative research about students in physical education, similar descriptions were found. This fact is also a validation of our results that students are not a uniform group where all students value, experience and behave in the same way. The nature of teaching physical education is complex and student learning and experiences are different from the teacher's intensions (Dodds, 1985, Locke, 1987). Students value non-educational features (mostly fun), and such as passing the class, and spending time and playing with friends (Cothran, 2010). Students also navigate within physical education lessons by altering their participation from low to high activity and visibility (Fi-

sette, 2013). Therefore, it is important for teachers to see and recognize different participation styles in all students.

Physical activity makes physical education distinctive from other school subjects. However, the goals of school physical education are numerous and the general aim of physical education in Finland has been defined as building the students' self-esteem and positive physical self-concept through favorable school physical education experiences and to encourage cooperativeness and positive future sport and health behavior. These diverse goals conflict with reaching the physical activity guidelines in teaching physical education, while in this study students' average activity level was lower than the guidelines. Bennie & Langan (2014) also reported that while the physical education teachers had optimistic ambitions, the teachers acknowledged that physical activity comprised just one aspect of their daily lessons. While physical education time is limited, there might raise the question whether the 50% MVPA guideline is realistic. Nevertheless, high levels of active learning time must be balanced with instruction, feedback and reflection and that is where the teacher's expertise in meeting curriculum demands is important.

While student motivation and ability seem to be related to their physical activity, it is important to attend to the suitability of the physical education curriculum to optimize the participation of diverse students. This study and previous research (Constantinides, 2011, Fisette, 2013; Griffin, 1984, 1985; Smith & Goc Karp, 1996; Tischler & McCaughtry, 2014) might suggest that the large emphasis on team games in physical education could be responsible for this phenomenon. It seems doubtful that games dominated physical education with an emphasis on competition and on the learning of individualized skills, is able to motivate all different students. In response to this, Tischler & McCaughtry (2014) noted that students felt that the climate was manifested differently in lessons based on the Adventure Physical Education model, although student physical activity level might be lower (Gehris et al., 2012). In addition, Gutierrez & García-López (2012) concluded that the use of the pedagogical principles of Teaching Games for Understanding and the Sports Education model provides proper resources for challenging gender stereotypes in invasion games. New and different curriculums are not the single solution, but we see them as possibilities to strengthen students' opportunities to be equally active.

Despite some interesting findings, the study has several limitations. The short-term nature of data collection from three physical education lessons might provide just a narrow picture of physical education. We measured student physical activity, however reporting teacher perception and philosophy and an objective measure of teacher behavior would provide a more holistic and multidimensional perspective of the teaching and learning in the class. It also needs to be acknowledged that generalizability of our results to other school contexts could be limited by the modest sample size and by potential selection bias. Hence, further studies are needed to examine whether these participation styles can be observed in other contexts and cultures. Additionally, further research is needed to confirm whether approaches intended to increase participation have positive or negative implications for the diverse student population.

5. Conclusion

Physical education has the potential to positively impact children by providing opportunities for active learning. Several contextual factors are contributors to our reported participation styles. The main reason for this appears to be differences in students' fitness levels, physical activity behavior and interest in physical education. Student performance is both dynamic and temporal within the context of physical education, and a key to success here is the ability of the teachers to see, understand and make connections between students' backgrounds and their behavior in class. This reinforces the importance of good teaching skills as a potential means to help all students in the class. The large variation among individual students shows that each student should be treated separately and that a "one size fits all" approach to teaching physical education doesn't work.

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Children's Physical Activity and Associated Variables during Preschool Physical Education

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Abstract

Physical activity (PA) is important for children's growth and development and for their current and future health. Schools, especially during physical education (PE), are important locations for children to accrue PA. The purpose of this study was to assess the PA levels of preschool children during structured PE lessons and to evaluate the impact of selected characteristics (e.g., lesson context, length, and location; teacher behavior; class size; activity area density). Trained observers used SOFIT (System for Observing Fitness Instruction Time) to assess 90 structured PE lessons taught by 25 different teachers. Intact classes (n = 5 to 6 and representing 3 different grade levels) in 4 selected preschools were observed on 4 days over a 4-week period. Overall, children engaged in moderate-to-vigorous physical activity (MVPA) 49.9% (SD = 15.7) of lesson time and there were differences in MVPA% among the four preschools, by lesson context, and by teacher behavior. There were no significant differences in MVPA% either between indoor (n = 69) and outdoor (n = 21) lessons or among the 3 grade levels. Even though the lessons approached the 50% MVPA guideline, the brevity of them left children far short of recommended daily amounts of PA. Future studies should investigate how preschools can increase on-campus opportunities for PA both during PE and throughout the school days.

Keywords

Environment, Hong Kong, Movement, Observation, School

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1. Introduction

High rates of physical inactivity during childhood are problematic in most developed countries, and they are believed to be a direct or indirect cause of many pediatric diseases. Physical activity (PA) in young children can help to improve their cardio-metabolic profile (Janssen & LeBlanc, 2010) and bone health (Janz et al., 2004), contribute to their gross motor skill and psycho-social development (Timmons, Naylor, & Pfeiffer, 2007) and help to protect against child obesity (Reilly, 2008; Waters et al., 2011). In line with the growing concern about childhood obesity worldwide (Wang & Lobstein, 2006), promoting PA in young children has become increasing important for public health.

With the recognition of the importance of PA, recommendations and guidelines for PA are emerging from government and professional groups, even for young children (Pate & O'Neill, 2012). For example, in the USA the National Association for Sport and Physical Education (NASPE, 2011) recommends that preschoolers should accumulate at least 60 minutes of structured PA and up to several hours of unstructured play time every day and the American Heart Association (2014) recommends that all children aged 2 and older should participate in at least 60 minutes moderate-intensity physical activities every day. Meanwhile, the Australian (Commonwealth of Australia, 2014) and UK (Department of Health, Physical Activity, Health Improvement and Protection, 2011) governments recommend that young children should accrue at least 3 hours of daily PA spread throughout the day. Contrary to popular thinking, young children are quite inactive (Tucker, 2008). The bulk of the evidence indicates that preschool children have low levels of moderate-to-vigorous PA (MVPA) and are engaged mostly in sedentary activities whether assessed by direct observation (Pate, Mclver, Dowda, Brown, & Addy, 2008), accelerometry (Cardon & Bourdeaudhuij, 2008; Pate, Pfeiffer, Trost, Ziegler, & Dowda, 2004), or pedometry (Reznik, Wylie-Rosett, Kim, & Ozuah, 2013). There are exceptions, however, especially in structured PA settings such as during preschool physical education (PE) lessons (Van Cauwenberghe, Labarque, Gubbels, De Bourdeaudhuij, & Cardon, 2012).

The significant role that schools play in providing and promoting PA and subsequently contributing to population health is well recognized (e.g., Institute of Medicine (IOM), 2013; Pate et al., 2006), and the recent "*Educating the Student Body–Taking Physical Activity and Physical Education to School*" report (IOM, 2013) suggests that schools should provide children with at least 50% of their recommended 60 daily MVPA minutes. Many children worldwide attend preschools and child care centers, and these locations have been identified as important sites for promoting PA. Reviews (e.g., Timmons et al., 2007; Tremblay, Boudreau-Larivière, & Cimon-Lambert, 2012) have identified numerous policies and practices within preschools and child care centers that influence PA, such as time allocated for PE and outdoor play and the amount of space and equipment available. Additionally, the education and training of staff and their behavior on the playground may also influence children's PA (Trost, Ward, & Senso, 2010) and the intervention literature suggests that teacher-planned and teacher-led activities during both indoor and outdoor sessions are important to children's PA accrual (IOM, 2011).

Most structured physical activities at preschools are part of PE, an important part of the preschool curriculum that provides regular opportunities for PA while promoting physical fitness and motor skill development and helping children develop cognitive, social, and emotional skills. While there are many ways to assess PA, validated direct observation instruments provide the distinct advantage of assessing the contexts in which the activity occurs (McKenzie & van der Mars, in Press). Of the available tools, SOFIT (System for Observing Fitness Instruction Time) (McKenzie, Sallis, & Nader, 1991) is widely used because it simultaneously measures PA and how lessons are delivered (i.e., context) and what the teacher is doing. Van Cauwenbergh et al. (2012), for example, recently used SOFIT to evaluate children's PA levels, lesson context, and teacher behavior in 35 preschools in Belgium.

The school physical environment influences the quantity and quality of PA that preschool children receive on campus, and Louie & Chan (2003) indicate that lack of play areas (particularly outdoor areas) appears to limit children's activity levels in Hong Kong. While Australia and Taiwan have mandatory preschool outdoor space requirements of at least 3 and 5 m^2 per child, respectively, Hong Kong has no such specifications. In Hong Kong, over 90% of preschool-aged children attend preschools, all of which are privately run and charge tuitions (Hong Kong Government Census and Statistics Department, 2006). Hong Kong is densely populated, and most preschools occupy part of a floor inside a multi-level residential building and do not have an outdoor PE space. Meanwhile, the Hong Kong Government Education Bureau (2006) recommends that preschools should offer 45 - 60 minutes or 60 - 105 minutes of daily physical fitness and music and arts for half-day and whole-day sessions,

respectively. Preschools typically schedule 25 to 30 minutes of PE daily during half-day sessions, but little is known about how active children are in these classes. Thus, the main purposes of the current study were to assess children's PA levels during PE and to determine how they were influenced by specific conditions such as lesson context and location, activity area density and teacher behavior.

2. Methods

2.1. Schools and Setting

Based on their structural and program differences, four preschools in Hong Kong were selected to participate; three had both indoor and outdoor PA areas and one had an indoor activity space only. **Table 1** presents information on the preschools, including the length of school day and size of indoor and outdoor activity areas. In each preschool, five to six classes across three preschool grade levels (nursery, lower grade, upper grade) were randomly selected for observation. A total of 90 lessons (nursery, n = 27; lower grade, n = 31; upper grade, n = 32; range = 19 - 24 lessons per preschool) of children aged 3 to 6 years were observed over a 3-month period. The lessons were from 23 different intact preschool classes observed over four different days and they were led by 25 different teachers (24 females; 1 male). The teaching experience of lead teachers ranged from 2 - 28 years (mean: 13.4 ± 7.4) and all had degrees or diplomas and were certified in Early Childhood Education. Each lead teacher had one assistant. Permission for the study was granted by the University Ethics Committee and written consent was obtained from parents of the observed children and the preschool principals.

2.2. Data Collection

Observation Schedule. SOFIT was used to record children's PA, lesson context, and teacher behavior during the PE lessons, and the observation schedule in each preschool consisted of four different week days spread over two to four weeks during summer season, 2012. Teachers were informed of the days that lessons were to be visited, but not about the precise behaviors to be coded; they were asked not to modify their original lesson content or instructional methods. Canceled lessons were re-scheduled on the same day of the following week.

SOFIT Instrument. Observation procedures followed the technical descriptions of the SOFIT training manual (McKenzie, 2012). Before the start of a class, four preschool children (2 boys, 2 girls) from a class were selected for observation. The observer sequentially focused on a target child for 4 consecutive minutes before changing to the next child. The recordings in each observation interval (10 seconds observe, 10 seconds record) contain information on *student activity levels* which were coded as 1 to 4 based on bodily movements of lying down, sitting, standing, walking, and code 5 (vigorous) for movements requiring greater energy than normal walking. *Lesson context* contained 6 codes about how the lesson was being delivered: management, knowledge, fitness, skill practice, game play, and free play. *Teacher behavior* was coded on what the teacher was doing during the observation interval: promotes and demonstrates fitness, instructs, manages, observes, and other. The following environmental conditions were also recorded once per lesson: lesson location (indoor vs. outdoor), class size (i.e., number of children participating), lesson length, size of area used, density (preschoolers per 100 m^2), air temperature (˚C), and humidity (%).

Table 1. Characteristics of four selected preschools.

Preschool	PE Lessons Observed (n)	Scheduled Lesson Length (min)	Mean Actual Lesson Length (min)	Mean Class Size (no.)	Indoor Activity Area (m^2)	Outdoor Activity Area (m^2)	Mean Area Used in PE (m^2)
1[ad]	19	30	20.2 ± 5.0	20.7 ± 2.2	96	360	163.3 ± 83.9
2[a]	24	25	19.5 ± 4.0	30.2 ± 2.6	160	350	179.2 ± 83.7
3[b]	24	24	20.8 ± 3.8	23.3 ± 4.2	67	150	87.8 ± 36.7
4[bc]	23	20	18.8 ± 3.6	20.0 ± 2.4	110	0	110.0 ± 0.0

[a]Provided half-day sessions only; [b]Provided both half- and whole-day sessions; [c]No outdoor activity area; [d]Tuition was 2.5 to 2.6 times higher than other preschools for half-day session.

Observer Training. Five observers completed training sessions conducted by the criterion observer (lead author), an experienced SOFIT observer and trainer. The observers practiced coding using pre-coded videos of PE lessons and observations of lessons in the field. Training procedures followed those specified by SOFIT manual (McKenzie, 2012), and reliability assessments during data collection showed observer agreement to be well over the established 85% criterion.

2.3. Data Analyses

SOFIT is a lesson-level measure, and the data for 90 lessons were averaged for statistical analyses. The main dependent variable was lesson MVPA percentage (MVPA%) which was computed by summing the proportion of time students engaged in walking and being vigorous. Independent t tests and one-way ANOVAs were computed to compare lesson location (outdoors, indoors), grade levels, the four preschools, and preschoolers per 100 m^2 (low, medium, high density). Correlations between MVPA% and percentage of time spent in each lesson context and teacher behavior categories were determined, and regression analysis was conducted to determine the amount of explained variance in MVPA% by the environmental variables. In addition to MVPA minutes and MVPA%, two other summary variables were computed: mean Energy Expenditure Rate per child (EER; kcal/kg/min), and Total Energy Expenditure per child per lesson (TEE; kcal/kg). EER was calculated using the following equation: (proportion of observations spent lying down × 0.029 kcal/kg/min) + (proportion of observations sitting × 0.047 kcal/kg/min) + (proportion of observations standing × 0.051 kcal/kg/min) + (proportion of observations walking × 0.096 kcal/kg/min) + (proportion of observations being vigorous × 0.144 kcal/kg/min). These energy expenditure constants for activity levels were derived from heart rate monitoring (McKenzie et al., 1991). Total Energy Expenditure (TEE), an estimate of the total energy expended per lesson per child, was calculated by multiplying EER by the lesson length.

3. Results

3.1. General

Of the 90 PE lessons observed, 19 (23%) were coded independently by two observers. Intraclass reliability coefficient averages for agreements between an observer and the criterion observer for the SOFIT codes were 0.89 for activity, 0.97 for lesson context, and 0.92 for teacher behavior, indicating good inter-observer reliability (Baumgartner & Hensley, 2006).

Observed lessons ranged from 9 to 30 minutes (mean = 19.8 ± 4.2 minutes), and the number of students in classes ranged from 11 to 36 (mean = 23.8 ± 5.0). Most lessons (77%) were conducted in indoor play spaces, and the overall mean size areas used for lessons were 133.8 ± 71.0 m^2.

The lessons were conducted in temperatures ranging from 23˚C - 37˚C (mean = 27.9˚C ± 3.3˚C) and humidity ranging from 41% - 67% (mean = 52.4% ± 6.2%). Because location and temperature variables were confounded, temperature was not analyzed as an independent variable.

The lessons primarily provided children opportunities to engage in fundamental movements, with the following activities seen most frequently: jumping (39% of lessons), crawling (32%), throwing (29%), moving on a balance beam (22%), climbing (20%), and tricycle riding (18%). Few lessons offered rhythmic activities (6%) or free play (2%), and activities involving sandbox, water, and parachute play were provided during only one lesson each.

3.2. Overall Student Activity, Lesson Context, and Teacher Behavior

Tables 2-3 present the number of minutes and proportion of lesson time for student activity levels, lesson context, and teacher behavior variables during the 90 lessons and by preschool. The large standard deviations and ranges indicate substantial variability among the lessons and among the four preschools. Overall, however, children engaged in 9.9 MVPA minutes per lesson (49.9% of lesson), with more time in walking/moderate activity (6.1 minutes; 30.3% of lesson) than vigorous activity (3.8 minutes; 19.5% of lesson). Children also spent a substantial proportion of lesson time standing (37.6%), but very little time sitting (12.3%) or lying down (0.3%) (**Table 3**). Boys were more active than girls (MVPA% = 52.8 ± 17.4 vs. 46.6 ± 19.5, $p = 0.002$; MVPA minutes per lesson = 5.6 ± 2.2 vs. 4.2 ± 1.9 minutes, $p < 0.001$) (data not shown).

Table 2. Lesson length, energy expenditure, and minutes per lesson for student physical activity, lesson context, and teacher behavior.

	All Lessons		By Preschool	Test of Equality across Four Preschools		
	(n = 90) Mean (SD)		(n = 19 - 24) Mean Range	*F*	*p*	η^2
Lesson length (min)	19.8	(4.2)	18.7 - 20.8	1.17	0.325	0.04
Lesson TEE ($kcal \cdot kg^{-1}$)	1.6	(0.4)	1.5 - 1.7	0.84	0.476	0.03
Student activity (min)						
Lying down	<0.1	(0.3)	0.0 - 0.1	0.45	0.719[b]	0.02
Sitting	2.3	(2.4)	0.9 - 3.6	7.85	<0.001[*]	0.21
Standing	7.5	(3.7)	5.9 - 9.5	6.90	<0.001[*]	0.19
Walking	6.1	(3.5)	5.4 - 6.9	0.61	0.614[a]	0.02
Vigorous	3.8	(2.9)	2.3 - 4.7	7.15	<0.001[a*]	0.09
MVPA	9.9	(3.7)	8.3 - 10.6	1.63	0.189	0.05
Lesson context (min)						
Management	3.8	(2.1)	2.3 - 5.5	13.45	<0.001[*]	0.32
Knowledge	1.4	(1.5)	1.0 - 1.9	1.93	0.137[a]	0.07
Fitness activity	2.9	(2.1)	1.8 - 4.2	6.29	0.001[*]	0.18
Skill practice	8.8	(5.0)	6.9 - 10.7	3.53	0.022[a*]	0.10
Game play	1.0	(2.9)	0.4 - 2.0	1.09	0.366[a]	0.04
Free play	1.9	(4.4)	0.0 - 4.8	6.94	<0.001[ab*]	0.19
Teacher behavior (min)						
Promoting fitness	4.2	(3.0)	3.5 - 4.6	0.90	0.448[a]	0.03
General instruction	1.4	(1.8)	0.8 - 2.2	3.54	0.022[a*]	0.12
Class management	9.3	(4.8)	7.8 - 11.9	3.04	0.033[*]	0.10
Observing	5.0	(4.4)	2.3 - 6.8	4.15	0.009[*]	0.13
Other	<0.1	(0.1)	0.0 - 0.1	1.75	0.162[ab]	0.06

[a]Significance based on Welch (by robust tests of equality of means) because of violation of homogeneity of variances; [b]Robust tests of equality of means cannot be performed because at least one preschool has zero variance; [*]Significant at $p < 0.05$.

Table 3. Energy expenditure rate and proportion of observed intervals for physical activity, lesson context, and teacher behavior.

	All Lessons		By Preschool	Test of Equality across Four Preschools		
	(n = 90) Mean (SD)		(n = 19 - 24) Mean Range	*F*	*p*	η^2
Lesson EER ($kcal \cdot kg^{-1} \cdot min^{-1}$)	0.1	(0.01)	0.07 - 0.09	4.86	0.004[*]	0.17
Student activity (%)						
Lying down	0.3	(1.3)	0.0 - 0.4	0.45	0.719[b]	0.02
Sitting	12.3	(13.6)	4.1 - 19.2	11.29	<0.001[a*]	0.19
Standing	37.6	(15.7)	29.7 - 45.9	6.57	<0.001[*]	0.19
Walking	30.3	(16.7)	27.7 - 32.8	0.50	0.683[a]	0.02

Continued

Vigorous	19.5	(14.3)	12.3 - 24.2	5.72	0.002[a*]	0.11
MVPA	49.9	(15.7)	40.9 - 56.0	3.52	0.018[*]	0.11
Lesson context (%)						
Management	19.5	(10.4)	11.8 - 26.3	11.65	<0.001[*]	0.29
Knowledge	7.1	(7.6)	4.7 - 9.9	2.38	0.081[a]	0.08
Fitness activity	14.5	(10.0)	8.6 - 20.7	6.29	0.001[*]	0.18
Skill practice	43.8	(22.6)	34.6 - 51.3	3.83	0.016[a*]	0.11
Game play	5.1	(14.4)	2.1 - 8.8	0.80	0.495	0.03
Free play	10.0	(24.0)	0.0 - 26.7	7.16	<0.001[ab*]	0.20
Teacher behavior (%)						
Promoting fitness	21.2	(15.6)	18.4 - 24.5	0.77	0.516[a]	0.03
General instruction	6.7	(8.4)	3.4 - 10.7	4.53	0.007[a*]	0.14
Class management	46.5	(21.5)	38.8 - 59.0	4.34	0.007[*]	0.13
Observing	25.4	(22.6)	11.4 - 33.1	3.74	0.014[*]	0.12
Other	0.1	(0.8)	0.0 - 0.5	1.70	0.173[ab]	0.06

[a]Significance based on Welch (by robust tests of equality of means) because of violation of homogeneity of variances; [b]Robust tests of equality of means cannot be performed because at least one preschool has zero variance; [*]Significant at $p < 0.05$.

Relative to lesson context (i.e., how PE was delivered), overall the largest proportion of time was allocated for skill practice (43.8%), followed by class management (19.5%), fitness development (14.5%), free play (10.0%), knowledge (7.1%), and game play (5.1%). There was no significant correlation between MVPA% and the percentage of time children spent in any of the lesson context categories (data not shown).

Overall teachers spent most of lesson time managing students and the environment (46.5%), followed by observing (25.4%), promoting and demonstrating fitness (21.2%), and providing general instruction (6.7%). Other (i.e., attending to tasks beyond the lesson) was coded infrequently (0.1% of lesson time).

3.3. Lesson Context, MVPA%, and Teacher Behavior

Table 4 shows substantial differences for MVPA% during the 6 different lesson contexts, with children being the most active during time allocated to skill practice (MVPA% = 61.0) and least active during time for knowledge acquisition (MVPA% = 16.7). Teacher behavior also varied during the lesson contexts, and teachers spent substantial time managing students in all 6 contexts (range = 13.1% to 93.9% of individual context time). The highest rates of inactive observing occurred during skill practice (42.5%), free play (39.3%), and game play (23.4%). MVPA% was negatively associated with the proportion of lesson time teachers spent instructing ($r = -0.21$, $p < 0.05$) and managing ($r = -0.26$, $p < 0.05$) and positively associated with the proportion of time they spent observing students ($r = 0.29$, $p < 0.05$) (data not shown).

3.4. Differences among Preschools

There were significant differences among the four preschools on numerous student activity, lesson context, and teacher behavior variables, both for lesson minutes (**Table 2**) and proportion of lesson time (**Table 3**). Of note, **Table 3** shows there were significant differences among preschools in the proportion of lesson time the children spent sitting, standing, in vigorous physical activity, MVPA, and EER. The preschool explained 17% of the variance in EER. The proportion of time allocated for lesson contexts were significantly different among preschools for all variables, except for knowledge and game play. As well, the proportion of time for teacher behavior variables, except promoting and demonstrating fitness and "other", differed significantly by preschool.

Table 4. MVPA and teacher behavior during six lesson contexts (n = 90 lessons).

	Proportion of Lesson and (min) for MVPA and Teacher Behavior in Each of 6 PE Contexts				
Lesson Context	Student MVPA%	Promoting Fitness	General Instruction	Managing Class	Observing Class
Management	40.4 (1.5)	2.9 (0.1)	1.4 (0.1)	93.9 (3.6)	1.9 (0.1)
Knowledge	16.7 (0.2)	33.4 (0.5)	52.5 (0.7)	13.1 (0.2)	0.0 (0.0)
Fitness activity	46.8 (1.4)	72.8 (2.1)	2.6 (0.1)	16.0 (0.5)	8.6 (0.2)
Skill practice	61.0 (5.4)	9.1 (0.8)	4.3 (0.4)	44.0 (3.9)	42.5 (3.7)
Game play	46.9 (0.5)	14.7 (0.1)	8.8 (0.1)	52.7 (0.5)	23.4 (0.2)
Free play	52.5 (1.0)	23.2 (0.4)	2.0 (<0.1)	35.1 (0.7)	39.3 (0.7)

Note: "Other" teacher behavior not included because it was coded for less than 0.2% of total lesson time.

3.5. Environmental Variables

Results from one-way analysis of variance showed that lesson MVPA% differed significantly among the four preschools ($F = 3.52$, $p = 0.02$). There were no significant differences in MVPA% for grade level, lesson location, class size, lesson length, or activity area density.

4. Discussion

Physical activity is important for children's growth and development; and while school PE has been identified as an important source for its accrual (IOM, 2013), relatively few studies of physical activity during preschool PE lessons have been reported. Most young children in Hong Kong attend preschools, with over two thirds of them attending half-day sessions (School Education Statistics Section, Hong Kong Education Bureau, personal communication, 25 November, 2014). During these half-day sessions most preschools offer one 30-minute PE lesson daily. As recess is offered rarely, PE is likely the only opportunity many preschoolers have to be physically active during school hours. Meanwhile, in Hong Kong many preschools are located inside multi-complex buildings that house only a small activity area for PE. Because a small area might limit physical activity levels, we sought to assess environmental conditions in this study of PE in Hong Kong preschools. This study follows our earlier investigations of PE in Hong Kong elementary and secondary schools (Chow, McKenzie, & Louie, 2008; 2009) and used the same observation instrument.

Overall the children spent about half their PE time in MVPA (i.e., 9.9 minutes) during lessons that averaged about 20 minutes in length. Thus, the intensity standard of 50% MVPA identified by USA Healthy People 2010 (USDHHS, 2000) and the Institute of Medicine (IOM, 2013) was met. This is a positive finding, especially in the light that PE lessons for young children rarely reach this physical activity level. Fairclough & Stratton (2006), for example, reviewed 44 elementary school PE studies and found children averaged only 37.4 ± 15.7% of lesson time in MVPA.

The high levels of MVPA% by the preschoolers in the current sample were similar to students observed in Hong Kong elementary PE lessons (i.e., 51%; Chow et al., 2008) and slightly higher than during 35 lessons observed in Belgium preschools (i.e., 46%; Van Cauwenberghe et al., 2012). Nonetheless, because their PE lessons were much shorter, children in the current sample accrued fewer overall MVPA minutes than those in the comparison studies. With only about 10 minutes of MVPA per lesson, the Hong Kong preschoolers fell 50 minutes short of the NASPE (2011) guidelines of 60 minutes of structured PA per day. Nevertheless, the activity obtained by the children during their PE is especially important because they were mostly sedentary during the rest of the school day (e.g., observations showed they were sedentary from 88.4% to 91.2% of the time during the 30 minutes prior to and after their PE lessons) (data not shown). Additional opportunities for children to engage in PA are thus needed, and this might result from increasing the length of PE lessons and adding recess time. As mean actual lesson length was only 81% of scheduled lesson length (i.e., 19.8 vs. 24.5 minutes), an additional strategy would be to implement accountability measures to ensure that PE lessons are held as scheduled.

Preschool girls have previously been found to be less physically active than boys both at home and during free play at schools (McKenzie, Sallis, Nader, Broyles, & Nelson, 1992) and girls are typically less active than boys during PE in both elementary (e.g., NICHD, 2003) and secondary schools (e.g., McKenzie et al., 2006). Nonetheless, the finding that girls accrued less MVPA during PE than boys in this preschool sample is discon-

certing. Even though the amount appears small (4.2 vs. 5.6 minutes/lesson; 6.2% less), MVPA is a critical element for both boys and girls to become physically fit and physically skilled and it helps to control for overweight and obesity. These outcomes are not only essential to children's growth and development, they are cumulative and their effects track into adolescence.

Increased attention to equitable opportunities for PA accrual during PE, which is a required subject matter, is warranted. This is not only because of the reduced health and development opportunities for girls, but because of social and political reasons—parents (especially of girls) and school administrators would be outraged if girls received only about 94% of the opportunities that boys received to master other subjects (e.g., reading and math and language skills).

There could be numerous reasons for the gender differences in MVPA during the lessons observed (e.g., biological, cultural, artifact of data collection), but it is beyond the capacity of this study to resolve them. Future studies could be conducted to address the issue, such as determining whether the PE curriculum is sufficiently girl-friendly or assessing whether teachers may differentially interact with boys and girls (e.g., have greater expectations for boys to be more active and achieve; call on them to demonstrate more often; provide them with different activities). In the interim, the finding of potential gender inequalities in opportunities to be active and learn during PE should be addressed during both preservice and in service teacher preparation programs.

The finding that MVPA% varied by preschool concurs with previous investigations (Dowda, Pate, Trost, Almeida, & Sirard, 2004; Pate et al., 2004), and as indicated in **Tables 2-4**, the relatively large standard deviations in child physical activity levels, lesson context, and teacher behavior, indicate that there was substantial variation in how PE lessons were conducted in these Hong Kong preschools. Class size and activity area density were not found to be significantly related to student MVPA%. These findings are contradictory to a study that showed having fewer preschoolers per 100 m^2 was associated with increased physical activity (Van Cauwenberghe et al., 2012); thus, class size and PE space parameters remain important variables for additional investigation.

Outdoor PE lessons are typically found to provide more physically active than indoor lessons (e.g., McKenzie et al., 2006; NICHD, 2003). Nonetheless in the current study and in one conducted in Hong Kong secondary schools (Chow et al., 2009), lessons held outdoors were not associated with increased PA. As well, one Australian study found using indoor space for gross motor activities in child care centers was associated with more PA and less sedentary time (Sugiyama, Okely, Masters, & Moore, 2012). Most Hong Kong preschools do not have sufficient space to be able to house outdoor play areas. In the current study only 23% of the observed lessons were held outdoors, and the preschool with no outdoor areas at all had the highest MVPA% (56%) during PE. For children to accrue ample PA in smaller spaces it is important that their teachers be efficient instructors, use an activity-based curriculum, and have sufficient equipment and supplies.

Overall the data are indicative that these preschoolers were participating in of high quality PE lessons. This includes the amount of time they were engaged in MVPA (about 50%), the relatively large proportion of class time allocated to skill development (44% of the lesson) and little to class management time (20%). With the exception of time allocated for knowledge, MVPA% was relatively high during all other lesson contexts including management time (**Table 4**). With only about 0.1% of teacher behavior coded as 'other', the data indicate that the teachers were fully focused on the lesson. This focus included teachers spending about 46% of their time managing the young children (e.g., keeping them on task), a rate much higher than that typically found with elementary and secondary school lessons and in a study of preschoolers in Belgium (Van Cauwenberghe et al., 2012). As expected, higher rates of teachers observing inactively (i.e., for at least 10 consecutively seconds) occurred during the contexts of skill practice, free play, and game play—times when it is important for teachers to observe for child skill performance and safety.

5. Summary, Limitations, and Recommendations

Our findings showed that preschooler's PA levels during PE were highly variable, suggesting that contextual conditions and teacher behaviors were important influences on activity levels. These findings need to be considered relative to several limitations, including being restricted to observations of 90 PE lessons. A further consideration is that only four different preschools were involved, limiting a comprehensive analysis of the potential of different environmental characteristics such as size of activity area, the presence or absence of outdoor activity facilities, and play equipment. Unlike our previous elementary and secondary studies which used a random sample of Hong Kong schools, these preschools were selected because they were substantially different. The strength of the study, however, was that the PE lessons were taught by 25 different teachers; thus, there was va-

riety in the content of lessons as well as the way they were conducted.

Meanwhile, sedentary living is a worldwide problem (World Health Organization, 2004), and is recommended that children should accrue at least 60 minutes of structured PA daily. PE is the only venue available for all children to engage in PA, become physically fit, and learn important movement skills. It is important to assess PE in order to determine how active children are in lessons and to identify modifiable factors that may improve them. Future studies should not only investigate how lessons impact in-class opportunities for PA and learning skills but also assess lesson factors that may promote PA beyond the lessons. Also, given the importance of teacher effectiveness in promoting children's PA levels during PE (e.g., McKenzie & Lounsbery, 2013), preschool teacher preparation programs need to provide quality training on effective instructional strategies and practice in leading structured physical activities.

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An Ecologic Approach to Chinese Traditional Ethnic Sports Education

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Abstract

This research aims to discuss and explore, from the perspective of Ecologic Education, the ecologic characteristics of the traditional Chinese sports education and the developmental direction of the teaching model of Chinese traditional ethnic sports education under the guide of the view of Ecologic Education. Firstly, this research explores the background of the appearing of the view of Ecologic Education and the basic ideas of Ecologic Education. After that, the writer of this article comes up with the ecologic characteristics particularly embraced in Chinese traditional ethnic sports education. These characteristics or features include the educational aim of pursuing harmony, the developmental model of advocating co-existence, the knowledge view of cultural circumstance, and the interactive and win-win relationship between teachers and students. After the analysis made above, the writer of this article further argues that under the view of Ecologic Education pursuing life education full of spirituality, focusing on the active construction of knowledge and exploring multiple ways of enculturation can be the very direction of the teaching model of Chinese traditional ethnic sports education.

Keywords

The View of Ecologic Education, Traditional Ethnic Sports Education, Teaching Model, Harmony, Co-Existence

1. Introduction

The Belgrade Charter in 1975 and the Tbilisi Declaration in 1977 symbolized the foundation of Ecologic Education. In 1992 UNCED passed Agenda 21 in which there was a specialized chapter to discuss the environmental and ecologic educational problems, which was a measure promoting the development of Ecologic Education. In the 21st century, ecologic crisis has become a tough problem that hinders the development of the world, hig-

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hlighting the importance and emergency of implementing Ecologic Education. The aim of this research article is to form a valid and credible approach to the construction of the teaching model of Chinese traditional ethnic sports education by discussing the ecologic characteristics of the traditional Chinese sports education and exploring the developmental direction of the teaching model of Chinese traditional ethnic sports education from the perspective of Ecologic Education or under the guide of it.

2. Understanding of the View of Ecologic Education

2.1. Ecologic Education Prompted by Ecologic Crisis

Ecologic crisis has always been one of world's hottest issues. People's knowledge about ecologic crisis stays on such problems as environmental pollution, green-house effect, extinction of species, sharp increase of population, shortage of natural resources and the like, all of which result from the predatory exploitation of nature. However, all those aspects just comprise of the overt part of ecologic crisis. The deeper crisis lurking beneath is the very crisis of humanity itself.

Ecology consists of three layers, namely, the ecology of nature, the ecology of society and the ecology of humanity itself. Then the ecologic crisis covers all these three layers. The ecologic crisis existing in human spirit is the most important factor that leads to other various crises. Ecologic crisis originated in the western industrial revolution and has become a global problem with the worldwide industrialization. It is safe to say that the origin of ecologic crisis lies in the western world and the root of it lies in the view of the relationship between human and nature. From the perspective of the traditional western philosophy, the dichotomy of subjectivity and objectivity imposed by those western philosophers like Descartes argues for the opinion of factitious division between human and nature. The early modern natural view characteristic of mechanism treats nature as lifeless and vulnerable to will. It also holds that the relationship between human and nature is the sheer one between subject and object, namely, the "I-it" relationship (Su, 1998); in the view of the traditional religion of western world, the Christianity developed in the western world is the religion having the strongest human-centered color that ever exists in the world (White, 1993). The Christian religion believes that human is the highest work by the God, created in accord with the "image of God", so human beings are spontaneously endowed with the rights to rule the other creatures; analyzing from the perspective of western ethics, we may find that the traditional western society supports the individual-centered ethic opinion and the banner of human rights flies high. They hold that the individual rights are above the collective and social ones and that an individual can pursue the maximum of his or her interests only if no others' interests are infringed upon. This isolated, atomistic view from the optimistic aspect extends to the largest degree the human value or from the pessimistic aspect guarantees the survival of human beings and all kindness is still the concrete kindness to humans while nature is only an affiliation (Rolston, 2000). Under such a background of philosophic views, religious ideas and ethic thoughts, the relationship between human and nature is doomed to be fragmented, twisted and apathetic. In this case, their attitude towards nature is of course cruel and predatory. When such view of value is projected on the dealing with the interpersonal relationship and with the other-and-self relationship, the emergence of ecologic crisis in society and in individual is inevitable. So the root of ecologic crisis lies in the crisis of humanity itself, or more specifically, the crisis of human spirit. To solve the spiritual problems, education assumes an obligatory responsibility. When the British economist E. F. Schumacher in his *Small Is Beautiful* discusses about addressing ecologic problems, he strongly supports the idea that education is the largest resource and the principal task of education is to instruct the view of value and to instruct how to treat life (Schumache, 1984). Thus, the ecologic crisis prompts the implementation of the Ecologic Education.

2.2. Basic Ideas of the View of Ecologic Education

The concept of "ecology of classroom" was first proposed by the US educationist W. Waller in *The Sociology of Teaching* in 1932 (Bogdan & Biklen, 2003). When people gradually become aware of and pay attention to ecologic crisis, Ecologic Education today has become a trend of the development of current education. Besides, the view of Ecologic Education is becoming more and more popular. The view of Ecologic Education is based upon the ecologic philosophy which holds that the essence of the world is a compound ecologic system of "human-nature-society" and the view supports the idea of the organic cognitive model. Upon such foundation, the basic ideas of the view of Ecologic Education are the followingS: the educational aim of developing complete

personality; advocating the networked and open knowledge system; educational method focusing on dynamic situation; advocating equal and harmonious relationship between the teacher and students.

3. Characteristics of Traditional Ethnic Sports under the View of Ecologic Education

Many ideas of ecology are well interpreted in the traditional ethnic sports when people analyze the traditional ethnic sports in the dimension of Ecologic Education. First of all, the compound ecologic view of "human-nature-society" is in accord with the idea of unity of heaven and man or the idea of "the co-existence between the world and individual and the integration of all things and individual" implied in the traditional ethnic sports of China. To be specific, under the view of Ecologic Education, the traditional ethnic sports contain the following features.

3.1. The Educational Aim of Pursuing Harmony

The traditional ethnic sports first pursue the harmony of human and nature. The traditional culture of China heavily focuses on the organic view of harmony or the idea of "integration of all things and individual". Meanwhile, the traditional ethnic sports are rooted in the small-scale rural natural economic base and many origins of sports are related with the rite for harvest and worship of gods. Sports such as five-animal exercises, qi gong and tai chi reflect the idea of "respecting the natural way and preserving the natural body". The traditional ethnic sports also pursue the harmony of human and society. "Courtesy" is one of the key cultural characteristics in China and the traditional ethnic sports highlight the idea that "morals are prior to craftsmanship and morals show themselves in craftsmanship". From the idea of the ritual archery "understanding the courtesy among monarch and subjects and understanding the order of the elder and the younger" to the Chinese martial arts saying "judging the heart by literacy while judging the morals by the use of force", all present the characteristic of moral requirement in traditional ethnic sports while morality is the key factor that adjusts and maintains the interpersonal harmony and the harmony of human and society. The traditional ethnic sports pursue the harmony of humanity itself. The traditional sports ideas of health keeping take a special place in the traditional sports culture of China. They are deeply rooted in the tradition of Chinese health keeping which follows the organic view, focusing on internal and external cultivation as well as integration of spirit and form and pursuing the dynamic balance of body and mind. In this case, it avoids the compensatory side effects to body and mind resulting from the blindly pursuit of being "faster, higher and stronger" in western competitive sports.

The educational aim of traditional ethnic sports is to pursue harmony and such kind of harmony is a comprehensive one, reflecting the harmony view of the integration of human, nature and society.

3.2. Advocating the Developmental Model of Co-Existence

Co-existence is a very vital concept in Ecologic Education. It mainly contains two levels in education: the co-existence of human and nature as well as that of all the various cultures. The co-existence of human and nature means the harmony between human and nature, a point having been argued in the former part of this paper. The co-existence of various cultures generally refers to the ideas of "living by oneself" and "behaving oneself" as well as the way of co-existing with other nations and diverse forms of cultures.

The traditional ethnic sports of China have a long history of several thousand years. Many traditional ethnic sports survive the time due to the developmental model of the cultural co-existence. That "greatness lies in capacity" and the idea "harmony without uniformity" represent the ever national spirit of China, creating the foundation of the developmental model of the cultural co-existence in traditional ethnic sports.

Concerning the sports education within schools of China, how to deal with the relationship between the traditional Chinese sports and the modern western sports is always a hot topic in the academic field. The strategy of "becoming a cultural power" imposed at the sixth Plenary Session of the 17th CPC Central Committee has made the topic more practical and urgent. The view of Ecologic Education advocates the cultural view of multiple co-existence and holds that different cultures belong to the heterogeneous and isomeric body which facilitates the production of new materials and new matters, preventing the tendency of cultural homogenization which is becoming more and more serious. Within school sports, we should actively explore the developmental models of the co-existence between traditional ethnic sports and modern sports of the western world, which is beneficial

for the inheritance and innovation of our traditional ethnic sports as well as the sharing of the excellent cultural fruit of all human beings.

3.3. The Knowledge View of Cultural Circumstance

For the perception of knowledge, the view of Ecologic Education first holds that knowledge is culture rather than "code". In the process of instructing knowledge, if it is only the abstract code vehicle that is presented by depriving of the cultural soil that knowledge is dependent on and by abandoning the rich cultural meanings, such type of knowledge instruction is lifeless and empty and cannot evoke the emotional resonance and the rational identity (Zhu & Peng, 2009). The knowledge of traditional ethnic sports is comprehensive and its system contains various kinds of direct, rich and stylized body movements and all kinds of value knowledge such as spiritual faiths, natural views and philosophical thoughts, etc. They all simultaneously exist in one concrete traditional sports program. Thus, the instruction of traditional ethnic sports is cultural rather than pure instruction of body movement. The complete instruction of traditional ethnic sports should focus on both aspects of body movement and spiritual culture and focus on the inheritance of the material aspect of the traditional ethnic sports as well as the cultural soul kept in the traditional ethnic sports, which can inspire and enrich the learning subjects' inner world and help them construct the ecologic world full of spirituality.

The view of Ecologic Education argues that knowledge is circumstantial rather than universal. Knowledge is characteristic of uncertainty, generativity and locality. The traditional ethnic sports are closely related with specific practice of living and production. Both the overt body movements and the covert value knowledge are based upon the cultural factors composed of a certain time, space, historical background and value system. But for the related cultural soil, all will mutate or even disappear. Take archery for example. As an ancient traditional ethnic sports program, it appeared in oriental China and occidental Greece several thousand years ago. But because of the different cultures that it was rooted in, great differences lie in its equipment, exercise modes, rules and views of cultural value. In China, it was a courtesy rite for showing the hierarchy of the monarch and subjects as well as that of the elderly and the young. While in ancient Greece it was a military training for building the body and protecting the country.

The view of circumstantial knowledge holds that the understanding of knowledge is subjective and generative, reflecting the choice and personal interpretation of knowledge by the learning subjects. The learning subjects are in a historical situation and the understanding and mastery of special knowledge are closely related with knowledge structure, view of value, life experience and psyche that the learning subjects have already formed. Dragon boat competition is a traditional ethnic sports program that is fairly well carried out in China. In Hunan province, people carry out this sports program to memorize Yuan Qu for his patriotism while in the western part of Hunan, people do it to worship the dragon for rain and pray for harvest. In Suzhou, people do it to memorize Zixu Wu whose hair all turned white over one night and who was fearless when facing death. The verse by the Tang dynasty poet Shi Li vividly presents the fighting spirit: the rows struggle for the destination; the sails in the foam approach the lotuses. Nowadays, people carry out the sports program mainly for exercising bodies, strengthening collective cohesion and celebrating festival. The shapes and colors of dragon boats and dragon boat raps are different in styles in different areas. When the dragon boat culture enters the sports class, the learning subjects will choose the understanding and comprehension of the culture and take advantage of it. In this case the dragon boat culture transforms from public knowledge into individual knowledge. So the culture of traditional sports can be presented as a circumstantial knowledge either in light of knowledge itself or from the perspective of the learning subjects.

3.4. The Interactive and Win-Win Relationship between Teachers and Students

The view of Ecologic Education focuses on the existence of individual as a unique life and the demonstration of living life and focuses the covert, lively and flowing emotionalization of life (Liu, 2000). The view of Ecologic Education is an open educational view, advocating the ecologic teacher-students relationship with mutual respect and equal position in dialogue. The teacher as the chief one in the equal relationship ought to squat and converse with students. While instructing the knowledge, the teacher should pay attention to evoking the subjective initiative of the learning subjects and promote the growth of organic life. Meanwhile, in the equal communication with the learning subjects, the teacher can not only increase his or her wisdom of teaching, but also perfect his or her value systems and improve the level of literacy. So the relationship between teachers and stu-

dents under the view of Ecologic Education is a new one that is interactive and benefits both sides.

Traditional ethnic sports education pursues the interactive and win-win relationship between teachers and students. The knowledge of traditional ethnic sports is circumstantial. It focuses on the personal interpretation and choice of the knowledge by the learning subjects. Teachers in teaching practice should make efforts to create an environment of teaching and learning that is open and equal and help students understand, master, digest and absorb the knowledge of traditional ethnic sports, which is based upon the necessary and beneficial guidance of knowledge. Understanding the form and meaning is the important content and cultural characteristic of traditional ethnic sports. Take the movements of "white crane spreading its wings" and "parting the wild horse's mane" in tai chi for example. Those technical movements cannot be taught in accordance with the western quantitative criteria while understanding the form and meaning is very personalized, requiring the learning subjects to understand and master it independently. That is why many foreign friends who are fond of tai chi show it with a different western style. And this objectively causes them to interpret and comprehend Chinese traditional ethnic sports in different ways. Another feature of traditional ethnic sports is locality. In actual practice of teaching and learning, some students of minorities can be more familiar and more professional than the teacher concerning the mastery of the traditional native sports, which leads to an interesting phenomenon in which the teacher becomes a student and vice versa. So it is the aim of traditional ethnic sports teaching and learning to pursue the interactive and win-win relationship between the teacher and students, and such pursuit itself is one of the features of the teaching and learning practice.

4. Teaching and Learning Model of Traditional Ethnic Sports under the View of Ecologic Education

4.1. Teaching and Learning Model to Pursue Life Education Full of Spirituality

Traditional model of teaching and learning of sports focuses on the instruction of the sports skills. In specific practice of teaching and learning, the procedure consists of the demonstration and explanation of movements by the teacher and imitation and exercises by students. After a certain exercise time and amount of exercise, most of students can master the basic movements and incur a certain amount of exercise load so that the aim of exercising body is realized. Such model views students as passive containers and simplifies the practice of teaching and learning into pure skill instruction, weakening the cultural connotation implied in the teaching and learning of sports. With this teaching and learning model that puts skills above culture, the inner worlds of the learning subjects do not receive full respect and enough cultural cultivation. So, how can we go on to talk about the development of human full of rich life energy and with healthy ecologic view? As Whitehead says, a person can understand all the knowledge of the sun, all the knowledge of the air and all the knowledge of the rotation of the earth but this person just cannot see the splendor of the sunset (Doll Jr., 2000).

The teaching and learning of traditional ethnic sports should be under the guide of pursuing spirituality and focus on the existence of each learning subject as living individual. In the process of teaching and learning of traditional ethnic sports, apart from instructing skills, exercising bodies and boosting health, we should also guide the learning subjects to experience and interpret the traditional faiths, pursuit of value and cultural meaning and to integrate with experience and understanding of the real living world, making them contemplate over the relationship of human and nature, of human and culture, of human and society and of human and self and in turn construct their own spiritual home and continuously enrich the spirituality of their lives. Shouyao Teng once said that when human beings pass the industrial civilization and enter the epoch of post-industrial civilization, art is like a cup containing the water of life which is prepared for the dry lips that are far away from nature while suffering from alienation in this epoch (Teng, 2006). The education of traditional ethnic sports should focus on the inner world of the learning subjects and integrate the instruction of techniques and skills with the understanding of cultural value, promoting the learning subjects' realization of life, cognition of self and development of spirituality and thus becoming the real life education.

4.2. Teaching and Learning Model to Focus on the Active Construction of Knowledge

The knowledge of traditional ethnic sports of minorities feature in culture and circumstance and the cultural feature and circumstantial one are bound to lead to the uncertainty of knowledge. So each learning subject's understanding of the same knowledge of minorities' traditional ethnic sports is different from others' due to the

different experience, emotion and religious belief of individuals. There is no unique, authoritative and doubtless answer. As the saying suggests, Hamlet varies from reader to reader. So, the learning subjects are no longer the "negative containers". Teachers also no longer hold the absolutely authoritative power of speech. The learning subjects no longer just receive the input of information but also realize the output of information. The model of teaching and learning should focus on the active construction of knowledge by the learning subjects and encourage them to express and communicate their thoughts freely. Of course the teacher still has the priority power of speech. Above all, the teacher owns more knowledge and information than the learning subjects. Firstly, the teacher needs to offer new information and knowledge to the learning subjects so that the learning subjects can make personal interpretation based upon such materials. This personal interpretation is precious for the modernization of traditional ethnic sports. The inheritance and development of traditional culture cannot go without care for reality. The endowment of modern connotation is necessary. The learning subjects' open and innovative minds are sure to bring forth beneficial thoughts for the development of modernization in traditional ethnic sports. Meanwhile, within such teaching and learning model that encourages expression and creation, the learning subjects not only obtain the true respect but also develop the self-confidence, which plays a positive role in constructing the learning subjects' ecologic value system and ecologic outlook of the world featuring equality and philanthropy.

4.3. Teaching and Learning Model to Explore Multiple Ways of Enculturation

Enculturation is an important mechanism for the spread and production of culture. Enculturation means the process of perceiving the traditional ideas and manners by the young people in the same cultural group through conducting the partly conscious and partly unconscious learning under the senior people's direction, guidance or enforcement. Enculturation is a vertical inheritance of culture. With the current process of globalization, the tendency of cultural homogenization is becoming more and more obvious and the western sports culture takes the lead in the global sports cultures. The ecologic view of value advocates the diversity of cultures and holds that all kinds of cultures should have a place to exist and develop in the world. Meanwhile, to construct a culturally powerful country has become the consensus of our society. Under such a historical background it is necessary to strengthen the enculturation of the traditional ethnic sports.

Traditional ethnic education of culture is an environmental education rendering into real life with social education and family education taking the main parts. In this way of education, the ethnic culture passes down mainly by the oral form from generation to generation and the people are influenced by the activities and rites and in turn receive inspiration, making choice with the change of life and consequently promoting the advancement of ethnic culture (Sun & Li, 2010). The way of enculturation in traditional ethnic sports culture has such features as the type of environment, the type of life and the type of experience. But because of the foreign culture shock and the change of economy, social education and family education as the main ways of enculturation of traditional ethnic sports have been declining. At president, the main way of enculturation of traditional sports is school education. School education is a high level conscious enculturation with certain coercion in terms of contents, methods and aims. In order to achieve fairy result, traditional ethnic sports education has to explore more ways of enculturation. We need to know that the influence of culture upon individual is realized through both of the overt and covert ways. In this case, the enculturation in school education should reflect the two features of overtness and covertness. The overt ways in traditional ethnic sports education are mainly presented in the form of teaching and learning activities within class. The scope of covert ones is wider, containing the traditional ethnic sports in traditional festivals, the shows of the folk sports artisans, intercollegiate competitions of traditional ethnic sports, etc. We should integrate the overtness and covertness and expand the ways of enculturation. We also should create a good situation of traditional ethnic sports and make sure that the learning subjects can obtain nourishment at any time in any places so that we can realize the profound and far-fetched function of enculturation of traditional ethnic sports or else it will become the nostalgia of epoch.

5. Conclusion

To sum up, Chinese traditional ethnic sports education is closely connected with characteristics of the idea of modern Ecologic Education. After the analysis and argumentation, this article provides the very direction of the teaching model of Chinese traditional ethnic sports education under the view of Ecologic Education, which is pursuing life education full of spirituality, focusing on the active construction of knowledge and exploring mul-

tiple ways of enculturation.

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The Influences of Taekwondo of Nursing School in Beihai City on the Comprehensive Development of Health School Girls

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Abstract

Taekwondo can affect many aspects from physical, psychological, temperament, and the overall quality of Health School girls and other personal development, helping to enhance their personal qualities. This paper analyzes the positive impact of taekwondo on the physical condition of girls in Health School, psychological, physical, and the overall quality of temperament, hoping to provide a reference for the promotion of taekwondo.

Keywords

Taekwondo, Health School, Girls, Influence

1. Introduction

Taekwondo is a fighting technique originated in the Korean Peninsula. Taekwondo practice not only can enhance the physique, physical fitness of students, but also has a positive impact on their sentiments (Liu, 2000). Current domestic universities carry out taekwondo curriculum for college students actively in order to promote physical and mental growth, especially for girls who do not have large sports interest. The movement and the effects are more objective, and thus taekwondo becomes popular in girl groups. In the following parts of the thesis, we would briefly discuss the role and value of taekwondo on Health School girls' comprehensive development.

2. Literature Review

Based on five journals concerning taekwondo from the internet, including the necessity and countermeasures of taekwondo in college education, The positive role of taekwondo on the development of college students, the significance of college students practicing taekwondo, I find the positive influences of taekwondo on students' devel-

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opment. Regarding these as the theories, this thesis analyzes the influence of taekwondo on schoolgirls of Nursing Schools in Beihai City in several aspects, such as physical fitness, mentality, body, temperament and comprehensive quality.

2.1. Constitution of Taekwondo to Health School Girls

In the aspect of physical fitness, it refers to the basic ability of human muscle activity, which is the integrated response of the function of organs, including strength, speed, endurance, delicacy and flexibility (Zhang, 2008). Take 100 schoolgirls in the taekwondo Association as an example. 89% of them have made improvement in strength, speed, endurance, delicacy and flexibility in different degree after one-term practice. And thus, taekwondo plays an important role on students' physical fitness.

2.2. Effect of Taekwondo Exercises to Female Psychology

Taekwondo exercises help girls to actively improve their negative emotions and relationships. Taekwondo school students often need to shout at the time of the action, which will help the girls cry resolving negative emotions in mind, the mobilization of the nerve center of the brain to make it into the excited state, to boost their self-confidence and to play a role in your breath and courageous. In taekwondo competition, it also allows students to gradually increase the ability to control their own emotions, long-term exercise down. There is no doubt that taekwondo would be beneficial to mental health, reducing anxiety, depression and other negative emotions. Thus, it can be described as a valid exercise therapy. Health School female ones, just like other women in the world, are shy with poor communication methods with people. Taekwondo exercise can help them open their hearts, and gradually develop optimistic attitudes. In motion through communication with coaches, student exchanges gradual improvement in the ability to relate to people, affecting their mental choose from many aspects of daily life, enhancing their ability to communicate and cooperate with people, so that they can lead a better daily life and can learn better.

2.3. Effect of Taekwondo to Body of Health School Girls

Physical aspects of taekwondo itself as a fitness way can play a maintenance effect on the beauty of the female body. It is significant that taekwondo can help to lose weight and improve the physical effect. Thus, so much Health School girls welcome. Taekwondo can enhance the softness of the female body. It is aerobic exercise to consume the fat better by focusing on the legs the action. It also can be a good exercise to attack WHR, thigh muscles, keep muscles strong symmetry, so as to provide an effective exercise way to meet girls' need in pursuit of physical beauty (Wang, 2013).

2.4. Effect of Taekwondo to Health School Girls' Temperament

Taekwondo training exercises and combat can calm mental quality and develop the independence of strong self-awareness of Health School girls. Taekwondo attaches great importance to etiquette and ethics training, long-term exercise training exercise, which can lower those prudent minds, enhance their physical and mental qualities, who will play a role in honing exercises and confrontation that is the reason why this movement be loved. Taekwondo martial spirit advocated that keep etiquette, self-denial patience, perseverance and tenacity, start training around these spiritual goals, make women gradually develop panic mentality inspire courage in the confrontation, exercise smart response, and enhance their self-control ability and adaptability (Liu, 2012). Especially the confrontation in the face of strong challenges, can deeper physical and mental exercise, students gradually cool head and calm aspirations, enhance personal qualities. Taekwondo for Health School girls will meet current quality of exercise students' overall training objectives. In taekwondo practice, fails and injured are normal, especially in combat, confrontation is everywhere, the courage to face confrontation, to face failure with undaunted spirit, and tenacity when facing pain, are a necessary journey of an outstanding women, down the long-term exercise, it can enhance their ability to cope with failures and setbacks, and also can enhance women' defense capability and capacity to respond to unexpected situations. Taekwondo as a sport emphasizes confrontation requires the exerciser to overcome the physical and psychological difficulties faced by independent fail to overcome cowardice, evasion of mind, the difficulties, it can cultivate a strong sense of ownership of female independence.

2.5. The Influences of Taekwondo on the Comprehensive Quality of Schoolgirls in Health School

For the overall quality, the taekwondo can enhance their moral and cultural qualities, aesthetic qualities. Health School girls are of the age of about 16 - 20 years old, women in this age group is still in a critical stage of growth physically and mentally sharp, personal values undergone dramatic changes, especially women own unique psychological characteristics, so their tending for personal self-awareness and personal demand is more intense, this emphasis on etiquette taekwondo movement, so that they can be influenced by good etiquette to help the good moral quality of training. Taekwondo additionally can enhance their own defense capabilities, and also cultivate strong aspirations, in keep etiquette, under the influence of indomitable spirit, their hearts also get exercise, get internal quality culture, undoubtedly help to improve their moral quality. For the cultural qualities, the Health School girls have a certain cultural basis, but the overall cultural quality has yet to be improved, the face of the rapid social and cultural system update, remove to learn professional knowledge, other knowledge acquisition is also very important. Compared to the boys actively seeking out and developing, covering a variety of subjects, girls in terms of fun-loving is slightly narrow, traditional cultural understanding are not deep enough, taekwondo itself as a unique cultural history of foreign movement, help girls develop their cultural connotations, and also to enhance their cultural quality. As neighbors, China and North Korea culture is homologous. Taekwondo can be seen in many of the shadow of Chinese culture, such as taekwondo spirit on our country by Confucianism, Taoism ideological influence, taekwondo in the long-term development, the formation of both the health, connotation ethics, philosophy, mechanics, and other cultural and defensive depth understanding of taekwondo, allowing girls to better understand the Chinese traditional culture, so that they can comprehend the profound oriental culture (Wang, 2010). Taekwondo practice also allows girls to enhance the aesthetic sense, sensitive to capture life's beauty, sports beauty, mechanical beauty, spiritual beauty of my form, to let them grasp comprehend the inherent implication, and to enhance the aesthetic realm of Health School girls. Taekwondo lets the girls leave a deep visual audio to exercise their physique and mental focus on participation, coordinated physical and mental health, so that they gain in success and failure in their insights on life, culture confident, cheerful and other personality traits, training hardworking spirit. Thus, they would become fun and elegant, perfect personality talents, and enhance the overall quality obtained.

3. Conclusion

In summary, through taekwondo Beihai Health School girls can be cultured to be gritty-minded and body-shaped so as to help them enhance their morality, culture and aesthetic accomplishment, and to promote their access to comprehensive development, taekwondo is a kind of multi-effects exercise, which is worth promoting learning.

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An Explorative Study of Possible Demographic Variables, Sports-Related Situational Variables, and Social Variables as Predictors of Athlete Burnout and Its Core Dimensions among German Non-Elite Endurance Athletes

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Abstract

Sport science has focused more and more on burnout in sports. Up to now, however, there are some studies that deal with burnout among coaches, but there are very few that deal with burnout among athletes. This article provides an overview on the topic and presents data from a cross-sectional study of 785 non-elite endurance athletes regarding possible predictors of athlete burnout. Burnout was assessed with a German version of the *Athlete Burnout Questionnaire* (ABQ; Raedeke & Smith, 2001), and multiple regressions were performed using burnout and its sub-dimensions as outcomes. 1.3% of the sample reported high levels of athlete burnout; various situational and demographic variables (e.g. training hours per week, gender, main sports) could be identified as determinants of the phenomenon. These results support the conditional theory (e.g. Coakley, 1992), which links burnout to environmental factors and sees stress as a symptom rather than a causal factor of burnout.

Keywords

Burnout, Sport, Triathlon, Running, Cycling

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1. Introduction

1.1. Definition

The term burnout refers to a psychological concept that is strongly characterized by the work of Freudenberger (1974) and Maslach (1976). Early burnout research typically focused on human service workers, later other occupational fields (e.g. managers, police officers, teachers and students) were studied as well (Maslach, Schaufeli, & Leiter, 2001; Maslach & Jackson, 1984). In the athletic environment, the burnout phenomenon was first investigated in the 1980s (Coackley, 1992; Dale & Weinberg, 1990).

Due to a wealth of theoretical models regarding the aetiology of the burnout phenomenon, there is no definition of burnout that is commonly agreed upon (Dale & Weinberg, 1990; Kallus & Kellmann, 2000). Maslach & Jackson (1984), however, define three core characteristics that are widely accepted and can be identified in most burnout definitions: exhaustion (physical, mental and emotional), cynicism (depersonalization) and low personal accomplishment (Dale & Weinberg, 1990; Maslach et al., 2001). Moreover, the burnout syndrome is accepted as being a reaction to chronic, but not occasional stress that develops over time (Dale & Weinberg, 1990). The operationalization of the abovementioned burnout dimension can be found in the *Maslach Burnout Inventory* (MBI), the historically first instrument to measure burnout (Maslach & Jackson, 1996).

Regarding the symptoms of burnout, Schaufeli & Bunk (2003) identified five major categories related to the syndrome: affective manifestations (e.g. depressed mood and hostility), cognitive manifestations (e.g. feeling helpless and cynicism), physical manifestations (e.g. psychosomatic complaints and exhaustion), motivational manifestations (e.g. resignation and lack of enthusiasm) and behavioural manifestations (e.g. absenteeism and impaired performance).

1.2. Athletic Burnout

Within the sport domain, Raedeke (1997: p. 398) defined burnout as a "syndrome of physical/emotional exhaustion, sport devaluation, and reduced athletic accomplishment". Burned out athletes may therefore feel physically and emotionally exhausted from demands associated with training and competing. They may furthermore feel a reduced accomplishment concerning their sport skills and abilities, which means that they are unable to achieve personal goals or perform below expectation (Goodger, Gorely, Lavallee, & Harwood, 2007; Raedeke & Smith, 2001). Unlike Maslach & Jacksons's (1984; 1996) burnout definition, depersonalization did not seem to be a salient dimension of athlete burnout and was therefore replaced by the concept of sport devaluation, meaning that athletes stop caring about sport and their own performance (Raedeke & Smith, 2001). Raedeke's (1997) approach is a multidimensional one that joins the three core characteristics of burnout. Furthermore, it serves as the basis of the *Athlete Burnout Questionnaire* (ABQ), a psychometrically sound measure of athlete burnout (Raedeke & Smith, 2001). Most data on athlete burnout acquired with the ABQ have been from English-speaking populations. However, translated versions of the questionnaire, for example in Chinese, German or French, have been developed and may serve to investigate cross-cultural psychometric quality of the ABQ (Eklund, Smith, Raedeke, & Cresswell, 2012).

In its consequence, the burnout syndrome often leads to decreased performance or withdrawal from sports (Eades, 1990; Smith, 1986). A detailed outline of physiological and psychological symptoms of athlete burnout is given by Cox (1998). Burnout, for example, often correlates with insomnia, increased resting and maximum heart rate, muscle pain, low self-esteem or reduced social interaction.

1.3. Aetiology

As already mentioned, there is a variety of theoretical concepts dealing with the developmental of burnout. They can be loosely classified as focusing on personal or situational aspects as causal factors related to burnout.

Representatives of aetiological burnout concepts that highlight personal factors are Schmidt & Stein's (1991) "Investment Model of Burnout and Dropout" and Smith's (1986) "Cognitive-Affective Model of Stress and Burnout", for instance.

The "Investment Model of Burnout and Dropout" (Schmidt & Stein, 1991), which is based on conceptions of commitment by Kelly (1983) and Rusbult's (1980) "Investment Model", tries to distinguish between athletes who continue their sport participation, drop out or burn out from a commitment perspective. Schmidt & Stein (1991) claim that burnout is more than a simple reaction to stress, but also depends on the athlete's commitment

to his sport. Thereby, the athlete's commitment is influenced by rewards and costs associated with sport, attractiveness of alternatives and investment that have already been made. Depending on the reasons for their commitment, some athletes are more likely to burn out than others. For example, if they only maintain their participation because of a lack of alternatives, they will not feel satisfied with the outcomes of their performance.

Smith's (1986) "Cognitive-Affective Model of Stress and Burnout" sees burnout as a result from chronic stress. According to Smith (1986), stress results from a repeated imbalance between demands (external or internal) and resources. Thereby, both "overload" (demands exceed resources) and "underload" (resources exceed demand) can cause the imbalance. Depending on individual cognitive appraisal of the situation and coping strategies, athletes may develop symptoms related to burnout.

Models favouring a condition-based perspective explain that the development of burnout is due to job or organizational characteristics. Cherniss (1980), for example, highlights eight environmental factors (e.g. workload, intellectual stimulation and leadership) that determine burnout in an organizational setting. Similarly, Pines, Aronson, & Kafry (1981) also see the reasons for burnout in situational job-related factors, e.g. lack of feedback, little scope for independent actions or lack of social support.

For the context of sports, Coakley (1992) provides an "Identity Development and External Control Model" to explain burnout development from a sociological perspective. With respect to burnout models that focus primarily on stress (e.g. Smith, 1986), Coakley (1992) affirms that chronic stress is related to the development of burnout. However, from Coakley's (1992) point of view, stress cannot be seen as a central cause for burnout, but as a symptom attached to it. Especially regarding adolescent athletes, Coakley (1992) claims that burnout is a result of the organizational structure of competitive sports and its influence on identity and control issues in young athletes. High engagement of parents, coaches, managers, etc. in adolescent athlete's sport participations may prevent the development of a sense of personal control and autonomy. Furthermore, the intensive sport participation may lead to the development of a one-dimensional identity where adolescents define themselves exclusively as athletes (for example, because of lack of time, the young athletes are not allowed to participate in non-sport activities or meet peers outside the context of sports). If athletes then start questioning the value of sports (e.g. when injured or not successful), a lack of control and one-dimensional identity may therefore contribute to the development of burnout (Coackley, 1992; Gould, 1996; Raedeke, 1997).

1.4. Research on Athlete Burnout

So far, only few studies have focused on athlete burnout (Raedeke & Smith, 2001) and hardly anything is known about epidemiological data (Smith, 1986). Empirical research in sport settings has predominantly focused on coaches, athletic teachers or officials, while athletic populations have not been investigated until the 1990s (Dale & Weinberg, 1990; Goodger et al., 2007; Kallus & Kellmann, 2000).

In a literature review, Goodger et al. (2007) explored the findings of 58 published studies on burnout in the context of sports with 27 articles focussing on athlete burnout. They identified three types of variables that were examined as correlates of burnout in the reviewed studies: psychological, demographical and situational (sports-related). Whereas research on athletes has mostly been examined as an individual psychological phenomenon with a focus on psychological factors, coaches have mostly been studied from a situational perspective. Athlete burnout is therefore characterized by the following psychological correlates: amotivation, lack of enjoyment, ineffective coping skills, high perceived stress, mood disturbance, insufficient recovery and low perceived social support. Yet, it remained unclear which demographic (e.g. age and material status) or sports-related situational (e.g. experience and type of sport) correlates might be associated with athlete burnout, as Goodger et al. (2007) could only identify "training volume" as one potential situational factor related to the phenomenon. However, Ziemainz, Abu-Omar, Raedeke, & Krause (2004), who examined burnout among a sample of male German elite athletes from a conditional perspective, found training volume, intensity of training and additional workload to be relevant predictors of burnout. Nevertheless, the relationship between sociological factors and athlete burnout remains under researched and will therefore be the central focus of this study.

1.5. Aim of the Study

The present study shall contribute to the epidemiological knowledge base, regarding athlete burnout from a sociological perspective. Apart from prevalent data, it will focus on different possible demographic (age and gender) and situational variables as predictors of athlete burnout and its core dimensions, according to Raedeke &

Smith (2001). Thereby, we will differentiate between social and sports-related situational variables. Social variables are represented by relationship status and variables indicating social support concerning training issues (training group and family conflicts because of training). Sport-related variables are years of training, main sports and training volume (weekly training hours and sessions). As most variables and their possible influence on the development of athlete burnout are under researched or reported findings are inconsistent, we will follow an exploratory approach without formulating any hypotheses.

2. Method

2.1. Participants

Different types of German endurance athletes were investigated as part of a cross-sectional study. Athletes were randomly recruited subsequent to six endurance sports events (two running events, two triathlon events and two cycling events) and asked to participate in the study by filling out a questionnaire and giving informed consent concerning the usage of their data. The response rate was 92.2% resulting in a total of 1089 completed questionnaires. Due to missing values 304 participants were excluded from calculations. The final sample size was 785, comprising 224 female and 561 male athletes. Mean age of the sample was 41 years. On average participants trained 4.6 times and 8.3hours per week. On average athletes had participated in their sport for 12.6 years. Information about other demographic and situational variables can be found in **Table 1**.

Table 1. Demographic and situational variables.

Variable	Statistics	
Gender	***N***	***%***
male	561	71.5
female	224	28.5
Age	***M***	***SD***
	40.8	11.3
Family conflicts regarding training (range: 1 - 5)	***M***	***SD***
	2.0	1.1
Relationship status	***N***	***%***
Married/stable relationship	604	76.9
Single/widowed/divorced	181	23.1
Training situation	***N***	***%***
Training group	372	47.4
Individual training	413	52.6
Training sessions per week	***M***	***SD***
	4.6	2.3
Training hours per week	***M***	***SD***
	8.3	4.5
Years of training	***M***	***SD***
	12.6	9.9
Type of sport	***N***	***%***
Running	231	29.9
Triathlon	306	49.6
Cycling	236	30.5

With regard to the competitive level of the questionnaire, respondents 11.5% participated in the "German marathon championships" (Deutsche Marathon Meisterschaften), 17.2% the "German championships in ultra triathlon" (Deutsche Meisterschaften im Ultratriathlon), 20.0% the "Arber cycling marathon" (Arber Radmarathon), 22.4% an Olympic triathlon, 10.8% a touristic cycling tour and 18.1% a fun run.

2.2. Instruments

Athlete burnout was operationalized trough a German version of the *Athlete Burnout Questionnaire* (ABQ-D; Ziemainz et al., 2004). Similar to the original version (Raedeke & Smith, 2001), the ABQ-D consists of 15 items assessing the three sub-dimensions of athlete burnout: emotional/physical exhaustion, reduced sense of accomplishment and devaluation (factor-analytic results can be found in Krause, 2002). Responses are given on a 5–point Likert scale ranging from 1 (almost never) to 5 (very often) whereby high scores represent a higher manifestation of athlete burnout. Regarding its psychometric quality, Ziemainz et al. (2004) reported good internal consistency (Cronbach's Alpha = .80) as well as good retest reliability (r = .70 to r = .90) for the ABQ-D. In the current study the subscales "emotional/physical exhaustion" and "reduced sense of accomplishment" showed acceptable reliability, whereas the "devaluation" scale did not meet the criterion of .70 (Nunnally, 1978). Nevertheless the overall burnout score still showed good internal consistency (**Table 2**).

Raedeke & Smith (2001) did not provide clear cut-off scores for the ABQ. However, reflecting the findings of Raedeke (1997), we defined athletes who scored three or higher on all three subscales to have high levels of burnout. A mean score of three or higher on two subscales was used to identify moderate levels of athlete burnout (also see Dubuc-Charbonneau, Durand-Bush, & Forneris, 2014).

2.3. Data Analysis

Using SPSS 20 mean scores and standard deviations for each subscale of the ABQ were conducted to determine athletes' burnout-levels. Four multiplelinear regressions (forced entry) were then conducted to identify possible predictors of athlete burnout. Thereby the overall burnout score and the three sub dimensions of athlete burnout served as dependent variables. All demographic and situational variables presented in **Table 1** were used as independent variables.

3. Results

3.1. Prevalence

The mean scores for "emotional/physical exhaustion", "reduced sense of accomplishment" and "devaluation" were 1.90 (SD = 0.63), 2.32 (SD = 0.64) and 2.07 (SD = 0.64), respectively. Thereby 1.3% (N = 10) of the athletes scored 3 or higher on all three subscales and 3.8% (N = 30) scored 3 or higher on two of the ABQ-subscales.

3.2. Regression Model

Between the single predictors levels of collinearity were low and all assumptions concerning the regression models were met.

3.2.1. Overall Burnout

As can be seen from **Table 3**, the examined predictors accounted for 9% of the variability in the overall burnout score. Three sports-related variables turned out to be significant predictors: weekly training hours as well as

Table 2. Descriptive statistics and Cronbach's alpha of dependent variables.

Variable	*M*	*SD*	Cronbach's Alpha
Overall burnout	2.10	0.48	0.70
Emotional/physical exhaustion	1.90	0.63	0.85
Reduced sense of accomplishment	2.32	0.64	0.71
Devaluation	2.07	0.64	0.55

Table 3. Regression models for the overall burnout score and the three subscales (only significant betas are presented).

Dependent Variable	R^2	Adjusted R^2	Independent Variable	Beta
Overall burnout	0.10	0.09	• Gender	0.08^{*}
			• Triathlon vs. running	-0.17^{***}
			• Training hours per week	-0.10^{*}
			• Family conflicts	0.20^{***}
			• Training sessions per week	-0.15^{**}
Emotional/physical exhaustion	0.11	0.10	• Gender	0.12^{**}
			• Family conflicts	0.21^{***}
			• Age	-0.10^{*}
Reduced sense of accomplishment	0.10	0.09	• Training sessions per week	-0.10^{*}
			• Training hours per week	-0.14^{**}
			• Triathlon vs. running	-0.12^{**}
			• Years of training	0.13^{**}
			• Family conflicts	0.18^{***}
Devaluation	0.11	0.09	• Gender	0.08^{*}
			• Training hours per week	-0.16^{**}
			• Training sessions per week	-0.21^{***}
			• Triathlon vs. running	-0.19^{***}
			• Triathlon vs. cycling	-0.10^{*}

Note. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

training sessions were negatively associated with overall burnout and triathletes scored significantly higher than runners. Furthermore gender proved to be a significant demographic variable predicting athlete burnout with men showing higher values than women. Regarding social variables family conflicts regarding training issues did also predict the overall burnout score.

3.2.2. Emotional/Physical Exhaustion

10% of the variability in the regression model using the sub dimension "emotional and physical exhaustion" as outcome was explained by the predictors. Again men scored significantly higher than women and family conflicts were positively associated with the outcome. Additionally age turned out to be a significant predictor of emotional/physical exhaustion (**Table 3**).

3.2.3. Reduced Sense of Accomplishment

Regarding the subscale of "reduced sense of accomplishment" the adjusted R^2 of the model was 9%. Years of training, weekly training sessions and training hours per week were significant sports-related variables that predicted the outcome. Additionally triathletes scored higher than runners and male athletes higher than female ones. Again family conflicts concerning training issues predicted the outcome significantly (**Table 3**).

3.2.4. Devaluation

The adjusted R^2 for the "devaluation" regression model was 9%. Only sports-related variables turned out to be significant predictors: Training hours and training sessions per week were negatively correlated with the outcome. Moreover triathletes showed more symptoms of devaluation than both cyclists and runners (**Table 3**).

4. Discussion

Aim of this cross-sectional study was to give some information about the prevalence of burnout in a non-elite athlete sample and to identify possible predictors of athlete burnout and its sub-dimensions. Thereby, sports-related and social situational variables as well as demographic variables were taken into account.

4.1. Prevalence

To identify athletes experiencing high levels of burnout, we used a cut-off score of three or higher on all subscales of the ABQ. Overall only very few participants of our sample met the described criterion or reported moderate levels of burnout with mean scores of three or higher on two subscales. Altogether our results appear consistent with previous findings on samples of elite or collage athletes that characterized athlete burnout as being a very rare phenomenon with prevalence rates of less than 10% (e.g. Dubuc-Charbonneau, Durand-Bush, & Forneris, 2014; Gustafsson, 2007; Hodge, Lonesdale, & Ng, 2008).

4.2. Summary and Interpretation of the Regression Analysis Results

Interpretation of the results has to be done carefully as all regression models showed low values of the adjusted R^2 parameter, an indicator of the generalizability of a regression model.

Given these circumstances both demographic variables turned out to be a predictor of athlete burnout and/or its sub-dimensions. Regarding gender men scored significantly higher than women on overall burnout and did also show more symptoms of emotional/physical exhaustion and reduced sense of accomplishment. These findings seem surprising as past research suggests female athletes to be more prone to burnout than male athletes (e.g. Cremades & Wiggins, 2008; Heidari, 2013). However, only few studies have examined possible gender differences in athlete burnout so far (Gustafsson, 2007; Harris & Ostrow, 2008) and those who did report inconsistent findings. In contrast to the abovementioned articles, Lai & Wiggins (2003) did not find any significant gender differences in athlete burnout, for example. Similarly, results concerning sex as a predictor of burnout in occupational settings outside the realm of sport are inconsistent, too (Maslach et al., 2001). This might be due to the fact that gender is often confounded with other sociocultural variables, such as gender role stereotypes, occupational roles or hierarchical positions (Cockerham, 2001; Maslach et al., 2001; Schaufeli & Bunk, 2003). Therefore it remains unclear which role gender plays in the development of (athlete) burnout.

Secondly age proved to be a significant predictor of emotional/physical exhaustion with older athletes showing less symptoms that younger ones. Similar findings are reported concerning the phenomenon of burnout in work contexts, indicating that burnout seems to occur rather at the beginning of career (Schaufeli & Enzmann, 1998). As most research on athlete burnout focuses on samples of young athletes it can only be speculated why older athletes are not as prone to physical/emotional exhaustion. Greater experience associated with better coping strategies might serve as protective factors.

When it comes to situational variables all sports-related factors turned out to be significant predictors of some aspects of athlete burnout. In contrast to past research results, that found training load to be positively associated with burnout (e.g. Goodger et al., 2007; Kellmann et al., 2001; Smith, Gustafsson, & Hassmén, 2010; Ziemainz et al., 2004), the amount of weekly training hours and sessions was negatively associated with overall burnout, reduced sense of accomplishment and devaluation in this study. It has to be noted that most research on athlete burnout is based on samples of elite athletes (Goodger et al., 2007; Gould, 1996) whereas non-elite athletes, with an average training amount of eight hours per week, were participants of this study. In non-elite samples of athletes burnout might be more psychologically (e.g. motivational aspects, feelings of control/pressure) than physically driven as training volume and intensity are not as high compared to elite athletes. This hypothesis may be supported by the fact that training volume was not a predictor of emotional/physical exhaustion. Therefore non-elite athletes may rather profit from higher training amounts as they mostly experience the positive aspects of exercising concerning their physical condition.

The training parameter "years of training" was positively associated with the sub-scale "reduced sense of accomplishment". Accordingly athletes with a longer training history reported more symptoms. As already mentioned most studies on athlete burnout examined young athletes (Goodger et al., 2007) so little is known about the influence of years of training regarding the phenomenon. It might be possible that with more years of training there is a growing discrepancy between the physical abilities and the set goals of an athlete. Thus the feeling of not being successful or not achieving one's goals would increase over time.

Furthermore main sports could be identified as a significant sports-related predictor of athlete burnout in this study. In detail triathletes scored higher on overall burnout than runners and did also show more symptoms of reduced sense of accomplishment and devaluation. Additionally triathletes scored also higher than cyclists on the sub-dimension of devaluation. A possible explanation for the higher values of triathletes may be found in the necessity of training three disciplines, which might result in greater feelings of stress. In general there is a lack of studies comparing different types of sports (Goodger et al., 2007), hence factors causing those different levels

of burnout have to be established in further research (e.g. different personality/situational correlates).

Considering social predictors of burnout only the amount of family conflicts regarding training issues proved to be significant. Thereby more frequent or serious conflicts predicted greater scores on the overall burnout scale as well as the sub-scales of emotional/physical exhaustion and reduced sense of accomplishment. These findings support former research that emphasizes the important role of social support considering the development of burnout (Goodger et al., 2007).

4.3. Limitations and Future Research

With respect to limitations of the recent study it has to be stated that some of the examined categorical variables were not balanced in their manifestations, for example men were overrepresented in comparison to women, and the generalizability of the regression models was very low.

For a better understanding and interpretation of the presented results further research will be necessary. When it comes to sports-related situational variables most studies have only focused on training parameters so far. The comparison of different types of sports should therefore be given some attention in future research, which would help to classify the recent results concerning the differences among cyclists, runners and triathletes.

Moreover socio-demographic variables and their relationship to the development of athlete burnout need to be further investigated. Especially when it comes to gender differences findings are rare and inconsistent and do therefore not provide any useful epidemiological knowledge. As for affective (e.g. depression) and anxiety disorders women generally show higher prevalence rates than men (Cockerham, 2001). Similar does not seem to count for burnout, a phenomenon related to depression (Leiter & Durup, 1994; Maslach, Schaufeli, & Leiter, 2001). Also little is known about the influence of ageor socioeconomic status, variables that are often employed in epidemiological (mental) health research (Cockerham, 2001).

Coakley (1992) argues that organizational structures of high performance sports prevent young athletes from having a meaningful control over their lives and develop a sense of autonomy. Concerning non-elite athletes and elite athletes, who have to practice an additional profession for financial reasons, the compatibility of job/studies and sports might also contribute to control and identity issues, as the double burden also constitutes an extraordinary psychological burden (e.g. Borggrefe, Cachay, & Riedl, 2009). Future research should therefore also focus on structural conditions that promote the development of burnout outside the realm of high performance sports.

5. Conclusion

In this study, a noteworthy huge sample of more than 750 non-elite endurance athletes, heterogeneous in age, gender, relationship status and type of sport, were examined, regarding their symptoms of athlete burnout. Apart from situational variables, demographic variables were also considered as being possible predictors of the burnout syndrome. As past research on athlete burnout did often investigate only small samples of young elite athletes of one type of sport, the recent study provides some new data regarding the circumstances of burnout development.

Although the generalizability of the presented regression model was very low, the results confirmed a relevant influence of situational and demographic factors on athlete burnout. Hence, the study supports the condition-based perspective (e.g. Cherniss, 1980; Coackley, 1992; Pines, Aronson, & Kafry, 1981), which suggests the main reasons for burnout development in organizational and social structural roots (Dworkin, 2001). Especially the aspect of having too little time to exercise, due to family obligations or job-related reasons, seems to be an important influential factor on athlete burnout in a non-elite sample. Hence, athletes who reported less training load were more prone to burnout in this study. Similar to stressful workplace conditions that Cherniss (1980) and Pines, Aronson, & Kafry (1981) hold responsible for job-related burnout, unfavorable situational factors regarding an athlete's everyday life (e.g. little social support, incompatibility of work/studies and training, and lack of understanding for the value of exercising), which limit his/her possibilities to exercise, may cause feelings of stress and lack of control and eventually lead to burnout in the context of non-elite sports.

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Effects of Two Warm-Up Modalities on Short-Term Maximal Performance in Soccer Players: Didactic Modeling

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Abstract

The purpose of this study was to investigate the effects of two warm-up modalities (scheduled before a soccer match) on short-term maximal performance and physiological responses in soccer players. Twenty soccer players (Age = 22.1 ± 4.4 years; Height = 183.2 ± 7.1 cm, Body mass = 77.6 ± 8.5 kg) participated in this study. They randomly performed two different pre-match warm-up protocols on separate days with different excitation order component sequences where the last component of the warm-up excitation sequence was imputed completed either in the middle (WU-1), or at the end of the warm-up (WU-2). During the completion of the warm-up, heart rate (HR), and ratings of perceived exertion (RPE) were recorded. After the warm-up, participants performed a repeated sprint ability test (RSA) and the five jump (5JT) test. The results revealed no significant differences in WU-1 and the WU-2 for HR and RPE. In WU-2 condition, significant differences in the 7th acceleration phase of the repeated 10 m sprint (S7) ($p < 0.05$) was observed in comparison to WU-1. Likewise, the performance of 5JT ($p < 0.05$), and the 10-m of the RSA ($p < 0.05$) increased to WU-2 in comparison with WU-1. In conclusion, we recommended performing warm-up at the end of pre-match rather than in the middle to ameliorate the performance of soccer players during the competition.

Keywords

Warm-Up, Sprint, Jump, Soccer Players, Didactic, Modeling

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1. Introduction

Warm-up is considered an essential factor to prevent athletes from muscular injury and to improve performance (Gracielle et al., 2007). The warm-up period is defined as a preparatory exercise designated to enhance subsequent competition or training performance (Hedrick, 1992). The purpose of warm-up is to prepare the athlete physiologically and psychologically, and to reduce the risk of injury (Bourne, 1992).

Several studies were conducted in the 1950s-1970s to investigate the effects of warming-up on athletic performance (Richards, 1968). In this context, approximately 60% of these studies found that warm-up was better to perform than no warm-up, whereas ~11% found that no warm-up was better, and the remaining ~29% found no significant differences between different protocols of warm-up and no warm-up (Blank, 1955).

Soccer requires high-intensity intermittent efforts (Fradkin, 2002) that include many sprints of different durations, rapid accelerations and decelerations, jumping, agility, etc. Thus, it seems that soccer needs an active warm-up. In this context, previous studies have shown that active warm-up increases performance (Ekblom, 1986). Most active warm-up routines integrate four types of exercise: "cardiovascular" often based on running; "muscular" including some "explosive strength" exercises; passive or active "stretching"; "specific" (i.e., miming the characteristics of the sport exercise). The specificity of these exercises is very important and most of them are miming some aspects (e.g., posture, rhythm, muscular action, inter-limb coordination, and angular displacement) of the competitive sport exercise or a part of it.

There is little data in the literature supporting that warm-up is a desirable part of pre-competition preparation. Consequently, there is more equivocation over what type of stretch, if any, to apply as part of warm-up strategies. In this context, the optimal warm-up modalities are still controversial (Bishop, 2003). For example, vertical jumping ability has been shown to be improved following strength-related warm-up (Brown et al., 2008; Woods et al., 2007; Burkett et al., 2005), or deteriorated if warm-up includes some static stretching (Gourgoulis 2003; Saez Saez et al., 2007).

Furthermore, the assessment of soccer players' sprint performance was well documented in the last decade. Previous studies measured soccer players' 30-m sprint performance with 2- to 3-minute recovery in-between attempts (Holt & Lambourne, 2008; Young & Behm, 2003). However, during a 90-minute game, it is unlikely for a player to have 2 to 3 minutes of passive recovery between sprints. He actually performs sprints and repeats them with a short recovery time, i.e., repeated-sprint ability (RSA) (Chamari et al., 2004). Therefore, RSA is considered to more effectively simulate and reproduce soccer game performance as compared with a single bout of sprint (Wisloff et al., 2004; Spencer et al., 2005). In this context, Rampinini et al. (2009) have shown that RSA performance is related to soccer game sprint performance and that soccer coaches have implemented a series of short sprints, in order to prepare their players for the coming match performance. In that regard, RSA tests consisting of less than 10 sprint bouts with 20- to 30-second recovery have been recommended (Stolen et al., 2005). Contrary to a single sprint in which energy is mainly derived from anaerobic metabolism, the energy during RSA (sprints and recovery) is derived from both anaerobic and aerobic metabolisms (Fitzsimons et al., 1993).

Based on the facts that warming-up in soccer should include all components requested during games, and that knowing that warming-up modalities are controversial, the purpose of the present study is, therefore, to investigate the effect of sprint sequence placed at the end or at the middle of the pre-match warm-up on short-term performances in soccer players.

2. Methods

2.1. Subjects

Twenty male soccer players voluntarily participated in the study. The subjects were engaged in soccer for at least 6 years. Descriptive characteristics of the participants are presented in **Table 1**. They trained for at least four sessions per week in addition to one official game match per-week. The training sessions lasted 90 min approximately. All subjects were examined by the team physician prior to the study, with a particular focus on orthopedic and other conditions that might preclude resistance training. All procedures were approved by the Institutional Review local Committee for the ethical use of human subjects, according to current national laws and regulations. Participants gave written informed consent after receiving both a verbal and a written explanation of the experimental design and its potential risks.

Table 1. The heart rate (HR) and rate of perceived exertion (RPE) scores revealed after the two warm-up modalities (i.e., in the middle (WU-1) and the end (WU-2) of the competition).

	WU-1	WU-2	*p*
RPE	3.05 ± 0.39	3.01 ± 0.32	NS ($p = 0.06$)
HR (Batt/min)	143.70 ± 15.49	143.30 ± 11.81	NS ($p = 0.91$)

*NS: no significant difference between WU-1 and WU-2.

2.2. Experimental Design

In a randomized order, the players performed a five-jump test and a RSA test after two warm-up protocols. The first warm-up protocol (WU-1) started with a 4-minute low-intensity jog followed by 8 minutes of general part (composed by moderate exercises of upper limbs, moderate exercises of lower limbs, and dynamic stretching), followed by 5-minute sprint exercises before performing 8 minutes of specific warm-up sequence consisting of exercises with ball. The second warm-up protocol (WU-2) was performed similarly to the first one. However, the sprint sequence was placed at the end of warm-up (after specific sequence). 10 minutes after each warm-up protocol, subjects performed a five-jump test and then a RSA test with a 2-minute passive recovery between tests. After each test physiological responses data were retained (i.e., HR and RPE).

2.3. The 5-Jump Test (5JT)

The 5JT test is a practical, validate and alternative to estimate lower limb explosive power of selected population (Chamari et al., 2004). The 5JT consists of 5 consecutive strides with joined feet position at the start and at the end of the jumps. The subject attempts to cover the greatest horizontal distance possible by performing a series of five forward jumps with alternate left and right foot contacts. Subjects were given three trials; the best result (greatest distance) was obtained for analysis.

2.4. The Repeated-Sprint Ability Test (RSA)

The RSA test consisted of seven 30-m sprints (7 × 30 m) separated by a 25-second passive recovery period (Spencer et al., 2005). This test was adapted from previous RSA cycling and running tests (Impellizzeri et al., 2008) that have been shown to be reliable and valid (Impellizzeri et al., 2008). A hand-held stopwatch measured the time for the 25-second recovery. The sprint times were recorded by electronic speed time system (Brower Timing Systems, Salt Lake City, UT, USA,) placed at departure, 10 m and 30 m. The players stood 0.5 m behind the sensor before they started sprint. Each player was instructed and verbally encouraged to give a maximal effort during all tests, The timing gate at sprint 30-m can be divided into two phases: the acceleration phase (0 - 10 m) and time spent in the maximal-velocity phase was calculated by subtracting the acceleration time from the overall time. The reliability of the RSA test was established in a previous study (intraclass correlation coefficient [ICC] = 0.98, $p < 0.0001$with a coefficient of variation [CV] of 3.6%) (Spencer et al., 2005). The ICC and CV for the total time (TT) were 0.95 and 3.4%, respectively (n = 20).

2.5. Training Intervention

Study procedures took place in the university, on a football field in the morning and on 2 nonconsecutive days. Each group performed randomly two different warm-up protocols: WU-1 consisted of general warm-up, sprint sequence and finally, specific warm-up; the WU-2 including general warm-up, specific warm-up and a sprint. After 10 min of passive rest, the physical tests (5JT and RSA) were completed done.

The general warm-up consisted of, common for all, of jogging for 4 minutes and up to including. 5 exercises to solicit the upper limbs (rotation, balancing as well as elevation and depression, done with a light jog to and fro over a distance of 20 m), followed by 5 exercises soliciting the lower limbs (elevation movement knee, heel to buttocks elevated, lateral displacement of both side and finally a rear run, every works runs with slightly pace). This sequence was completed with a series of lower body dynamic stretches; the movements selected were intended to warm-up the muscles used in soccer game. They mimic functional movements found in a competitive match, and the movements were carried out while jogging.

The specific warm-up lasted 8 minutes and consisted of the same exercise done with balls achieve with some working in pairs, exchange of different kinds of passes with both inside feet, shot with both feet, a long pass after a control, centering, hits, fly passes, head kicks. This specific sequence was finished by an opposition of ball conservation (5 against 5, on pa pitch measured 20 m × 30 m) limited to two touches ball.

Subjects completed a 4 minutes jog-run general warm-up before being assigned to either WP-1, or WP-2 warm-up conditions. In the WP-1 condition, subjects underwent 8 min of upper, and lower body active dynamic stretching (ADS) before completing 8 minutes of soccer-specific warm-up (SWP).

Each participant's heart rate (HR) and rate of perceived exertion (RPE) on the scale of (Impellizzeri et al., 2008) were collected in **Table 2**.

2.6. Statistical Analysis

All statistical tests were processed using STATISTICA Software (Stat Soft, USA). The Kolmogorov-Smirnov test of normality revealed the data were normally distributed. Once the assumption of normality was confirmed, parametric tests were performed. Performance measures were analysed using one way ANOVA with repeated-measures. The reliability of the RSA test was analyzed using the intra-class correlation coefficient [ICC]. The level of statistical significance was set at $p < 0.05$.

3. Results

The statistical analysis revealed that physiological parameters (i.e., RPE and HR) were unaffected after the two warm-up protocols (i.e., WU-1 and WU-2) ($p < 0.05$). Likewise, our results showed that performance of the five jump test increased significantly ($p < 0.05$) after the WU-2 with ICC for this analysis (~0.87). Our results showed a significant improvement in the performance of sprint of 10m (i.e., 7th sprint) and 20m (i.e., 1st sprint) after the WU-2 ($p < 0.05$) in comparison with WU-1. Concerning the results of repeated sprint of 30m, significant differences were observed in 1st, 2nd and 7th sprint ($p < 0.05$) with better performance after WU-2.

4. Discussion

The aim of the present study was to investigate the effect of including a sprint sequence in the end or at the middle of the pre-match warm-up on physical performance in soccer players. Our results showed that the inclusion of sprint sequence would be more beneficial for performance when it is placed at the end of warm-up. However, the soccer players were able to better jumping and sprinting and thus to develop optimal performance.

The major finding of our study was that performances of pre-game soccer warm-up including sprint sequence at the end of warm-up were better than a sprint sequence placed in the middle of warm-up. So, we found that the charge load imposed by the two warm-up protocols was similar and no significant difference ($p < 0.05$) was found for either RPE or HR. Previously, it has been demonstrated that performing a warm-up before any activity enhances performance during competition (Fradkin et al., 2010). Soccer had several demands such as physical,

Table 2. Performance results.

Variables	WU-1	WU-2	P
5JT (m)	11.51 ± 0.32	11.88 ± 0.41	0.03*
RSA 10 m	2.02 ± 0.09	1.95 ± 0.09	0.05*
S1 10 m	2.00 ± 0.10	1.91 ± 0.14	0.12
S2 10 m	1.97 ± 0.15	1.91 ± 0.13	0.37
S7 10 m	2.00 ± 0.14	1.89 ± 0.06	0.05*
S1 20 m	2.59 ± 0.12	2.49 ± 0.16	0.05*
S7 20 m	2.66 ± 0.18	2.72 ± 0.13	0.25
RSA 30 m	4.66 ± 0.15	4.63 ± 0.21	0.26
S1 30 m	4.56 ± 0.14	4.41 ± 0.21	0.05*
S2 30 m	4.56 ± 0.15	4.41 ± 0.21	0.05*
S7 30 m	4.71 ± 0.18	4.54 ± 0.16	0.03*

5JT: five jump test; RSA: repeated sprint ability; 10 m: acceleration phase; 20 m: maximal velocity phase; 30 m: continuous sprint; * $p < 0.05$.

technical and tactical. However, the warm-up is an important component of physical exigencies to prepare player for match.

The results showed that the acceleration phase of the seventh sprint of the RSA test was significantly better after the WU-end than after WU-mid.

This finding supports the study of (Sayers et al., 2008) who have found that jog 800 m, forward skips 4 × 30 m, side shuffles 4 × 30 m, and backward skips 4 × 30 m wish can be considered like dynamic warm-up with excitation exercise improve acceleration phase. In the same context, Little & Williams (2006) used 3 warm-ups protocols ending with ~4 minutes of incremental intermittent sprint and agility runs. They found that the best result in 10-m acceleration is observed with dynamic stretching, which support our finding since we have used dynamic stretching at the end of the general sequence of the two warm-ups. This result is also supported by the fact that the RSA test of 10-m calculated separately had a significant difference ($p < 0.05$) between WU-1 and WU-2. Additionally, performance obtained during the 5JT is significantly better ($p < 0.05$) in WU-2 than WU-1. One of the possible mechanisms behind the enhanced jumping and sprinting performance after dynamic-style warm-up is Post-Activation Potentiation. Indeed, it has been shown that activation of a muscle, may cause an enhanced of performance for some time after the cessation of the activation (Sale, 2002). PAP may be a result of increased phosphorylation of myosin light chains, increasing the calcium sensitivity of the myofilaments (Sale, 2002).

In the first 20-m high speed the WU-2 protocol produced significantly faster ($p < 0.05$) runs than did the WU-1 protocol, no significant result was found in the other six 20-m of the successive RSA-test sprints, this may by explained with the fact that, maximum stride length only occurs when the runner has reached peak speed that is, during the maximal-speed phase, additionally during it both stride length and the stretch shortening cycle duration are at their respective greatest, in the present study the emplacement of excitation sequence at the end (WU-2) may increase this effect which observed only in the beginning in the study of (Sayers et al., 2008).

The findings of this study are establish in 30m sprinting WU-2 have significant better results for the first, second and the last 30m among the seven sprints of the RSA protocol then WU-1. This result confirms those in previous studies showing that dynamic exercise increases the power and speed performance (Faigenbaum et al., 2005; Faigenbaum et al., 2006). In fact, Gelen (2010) found that dynamic exercises performed after 5 minutes of jogging positively affect sprint, slalom dribbling, and penalty kick performances and thereby power performance. Faigenbaum et al. (2006) investigated the acute effects of different warm-up protocols on anaerobic performances in teenage athletes. They stated that dynamic warm-up practice positively affect sprint, medicine-ball toss, and vertical jump performance.

Faigenbaum et al. (2005) evaluated the acute effects of different warm-up protocols on fitness performances. Or investigation demonstrated that moderate to high-intensity dynamic warm-up exercises activate high power performance.

5. Practical Applications

The results of our study, including the sprint activity sequence at the end of warm-up could improve running speed during a 30-m sprint, 20-m maximal-speed, 10-m acceleration and 5JT performance. Soccer success can be dependent on maximal performance which we are aware of the potential positive effects of the insert of sprint sequence at the end of any pre-competitive warm-up. This finding is of great practical interest for coaches soccer and fitness coach trainers.

6. Conclusion

Previous investigators have suggested that a warm-up including dynamic exercises that replicate movements to be performed during the activity are beneficial to performance.

Given the originality of this study, success can be dependent on maximal performance, which is aware of the potential positive effects of the insert excitation part at the end of any pre-competitive warm-up. This finding is of great practical interest for coaches and fitness training. In the end, we recommended that the pre-match warm-up should end with excitation sequence based on sprints. Although more researches in the future are needed on this topic, it can be suggested that dynamic exercise performed for warm-up purposes may increase explosive-power production increasing neuromuscular functionality. It can be proposed that the excitation sequence at the end of warm-up increases the excitability of speed-contracted units of target muscles, thereby making these units ready to play an important role during certain activities such as sprinting performance and

jumping abilities.

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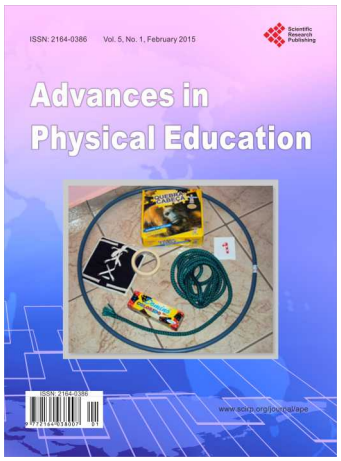

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