THE ICHPER·SD JOURNAL OF

Research in Health, Physical Education, Recreation, Sport & Dance

The Official Publication of the International Council for Health, Physical Education, Recreation, Sport, and Dance (ICHPER•SD)

Volume VI. No. 2
Fall & Winter 2011

TABLE OF CONTENTS

International Council for Health, Physical Education, Recreation, Sport, and Dance
Counsel International pour l'Hygiene, de l'Education Physique, de la Récréation, du Sport, et de la Danse
Consejo Internacional para la Salud, Educación Fisica, Recreación, el Deporte y la Danza

Founded 1958 in Rome, Italy
1900 Association Drive, Reston, Virginia 20191-1598, U.S.A.
(Phone: 703-476-3462; Fax: 703-476-9527; E-mail: ichper@aahperd.org; Website: www.ichpersd.org).

ISSN 1930-4595: ISBN 978-0-9821604-6-6 0-9821604-6-1: The ICHPER·SD Journal of Research is issued biannually by the International Council for Health, Physical Education, Recreation, Sport, and Dance (ICHPER·SD), 1900 Association Drive, Reston, Virginia 20191-1598, U.S.A. (Phone: 703-476-3462; Fax: 703-476-9527; E-mail: ichper@aahperd.org; Website: www.ichpersd.org). The annual subscription price of $50.00 is included in the annual ICHPER·SD membership dues as a membership benefit. ICHPER·SD members can purchase additional copies of the journal at $15.00. Nonmembers can purchase copies at $25.00 each.

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International Council for Health, Physical Education, Recreation, Sport, and Dance (ICHPER•SD)

ICHPER•SD Journal of Research
Volume VI, No. 2, Fall & Winter 2011

Physical Activity Patterns and Psychological Correlates of Physical Activity among Singaporean Primary, Secondary, and Junior College Students

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Abstract

The purpose of this research was to examine physical activity patterns and psychological correlates of physical activity among primary, secondary, and junior college students in Singapore. A sample of 3,333 school students aged 10 to 18 years took part in the study. Results showed that the younger students had significantly higher physical activity levels compared to the older students. In contrast, the older students had significantly higher prevalence of sedentary activity compared to their younger counterparts. Multiple regression analyses showed that the predictors of physical activity intention were different for the three age groups but similar between the two genders. Overall, these findings confirmed the characteristics of physical activity participation in school students and showed that physical activity and sedentary behaviors among students in Singapore were not inversely related to each other. In addition, results also showed that the psychological correlates were different for different age groups.

Key words: physical activity intentions, determinants, sedentary behaviors, lifestyles

According to the World Health Organization (2008), there are more than one billion overweight adults on earth, with at least 300 million of them clinically obese. The prevalence of obesity has reached an epidemic level. Unhealthy diets and physical inactivity are identified as two major causes of obesity and lifestyle diseases, such as coronary heart disease, type 2 diabetes, certain types of cancer and cardiovascular diseases (Bouchard, Blair, & Haskell, 2007; Bouchard & Katzmarzyk, 2010; Pate et al., 1995). In Singapore, the top causes of death are cancer, heart disease, pneumonia, stroke, accidents and violence, chronic obstructive lung disease, and diabetes (Ministry of Health, 2005). Cross-sectional studies and controlled trials have shown that regular exercise can offer protective effects of varying strengths on colon cancer (Lee, Paffenbarger, & Hsieh, 1991), coronary heart disease (Powell, Thompson, Caspersen, & Kendrick, 1987), hypertension (Hagberg, 1990), and non-insulin-dependent diabetes mellitus (Hardman & Stensel, 2009). Therefore, encouraging regular physical activity in young people is seen as a priority aim of many governments (e.g., The Class Moves in Wale, Project ACES in USA, Healthy Lifestyle Campaign in Singapore).

Activity patterns during childhood and through to adulthood are known to be related to age and gender (Gorely, Marshall, Biddle, & Cameron, 2007). We know that physical activity participation declines during the period of schooling (Myers, Strikmiller, Webber, & Berensen, 1996) and that the decline is greater in girls than in boys (Sallis, 2000). There are significant differences in physical activity and sedentary behavior patterns in the youth from different countries as well (Wang, Chia, Quek, & Liu, 2006). Therefore, there is a need to understand more about the current lifestyle of the youth in specific countries for guiding intervention programs (Sallis et al., 1992).

Previous studies often singled out multimedia technology or screen-based media as the main type of sedentary behavior to assess (Vandewater, Shim, & Caplovitz, 2004). This approach is now regarded as inadequate for understanding overall sedentary behaviors. A more accepted approach is to examine multiple sedentary behaviors in a wider context, such as TV viewing, video game playing, talking on the phone, sitting and talking to friends, using the computer, and reading and doing homework (Gorely, Marshall, et al., 2007; Marshall, Biddle, Sallis, Mckenzie, & Conway, 2002; Wang et al., 2006). Studies have established that physical activity and sedentary behaviors are not inversely related and that boys and girls have different patterns of sedentary behaviors. In addition, children from different countries also differed significantly in terms of their physical activity and sedentary behavior. For example, only 5% of boys and 6% of girls spent more than four hours per day watching TV in Singapore, as opposed to about one-third of children watching TV for four hours per day in the USA and the UK (Marshall et al., 2002; Wang et al., 2006). This suggests that differences could be due to different educational systems and/or cultures.

In addition to a descriptive approach to understanding children's and adolescents' lifestyles, Wang et al.'s (2006) study also showed that psychological correlates of physical activity should be identified at the same time. Wang and his colleagues showed that sport ability beliefs, perceived competence, and relative autonomy were key contributors in influencing the youth to participate in physical activity. An entity sport belief is a belief that sport ability is fixed and determined by nature. An incremental belief is a belief that sport ability is changeable through training and practice (Biddle, Wang, Chatzisarantis, & Spray, 2003). Perceived competence and relative autonomy are constructs central to self-determination theory (Deci & Ryan, 1985). Feelings of competence and autonomy facilitate intrinsic motivation in physical activity (Wang et al., 2006). Wang and his colleagues confirmed that young people with a combination of high incremental beliefs, low entity beliefs, high perceived competence and high autonomy tended to be involved in high levels of physical activity ("Self-Determined" cluster). However, they also revealed that psychological correlates with physical activity participation could be age-related.

The purpose of the present research was to examine physical activity patterns and psychological correlates of physical activity among primary, secondary, and junior college students in Singapore. It was hypothesized that (a) sedentary activity and physical activity patterns would differ between genders, (b) the patterns of sedentary and physical activity participation would differ among the three age groups, (c) the predictors of physical activity intention would differ between genders, and (d) the predictors of physical activity

intention would differ among the three age groups.

Methods

Participants

A sample of 3,333 school students aged 10 to 18 years from 28 schools took part in the study. There were 1,479 primary school students, 1,451 secondary school students, and 403 junior college students (1,257 boys, 1,963 girls and 113 participants who did not indicate their gender). The students were attending primary grade four level to junior college year two in the Singapore school system.

Procedures

Ethical approval was granted from the host University Ethic Review Board. The Ministry of Education granted the permission to conduct the study. Subsequently, the school principals were approached with a formal letter requesting consent for the study. All participants were told that their participation in the study was voluntary and they were free to withdraw at any time. The participants took 15 minutes to complete the questionnaire that was administered by research assistants in a quiet classroom setting. Participants were told that there were no right or wrong answers and were assured of the confidentiality of their responses.

Measures

Modified self-administered physical activity checklist (SAPAC). We used the modified SAPAC with a 7-day physical activity recall from previous studies (Marshall et al., 2002; Wang et al., 2006). The SAPAC included 32 activities that were grouped as sports, dances, exercises, and general physical activities. The participants were told to recall what activities they had engaged in the previous seven days and how many minutes they participated in each of these activities. There were seven sedentary activities listed on the SAPAC as well, and they were computer/internet, playing video games, doing homework, leisure reading, sitting and talking/ listening to music, talking on the telephone, and watching television. Participants were also asked to recall and write down minutes they spent on each of these sedentary activities during the previous seven days. Studies have established the reliability and validity of the 7-day recall SAPAC (Marshall et al., 2002; Sallis, Strikmiller, Harsha, & Feldman, 1996).

The achievement goal in physical education questionnaire (AGPEQ). The 12-item AGPEQ (Wang, Biddle, & Elliot, 2007) was used in this study. It was designed to measure four achievement goals in the Physical Education (PE) context. Wang and his colleagues (Wang, Liu, Chatzisarantis, & Lim, 2010) confirmed the validity of the measurement model of the AGPEQ. The internal consistency coefficients (alpha) for mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance in the present investigation were .79, .72, .81, and .64, respectively.

Perceived mastery and performance climates. The participants' perceived motivational climate in PE was assessed using a 13-item inventory (Marsh, Papaioannou, Martin, & Theodorakis, 2006). There are seven items measuring perception of mastery climate and six items measuring perceived performance climate. The results of the confirmatory factor analysis (CFA) by Wang et al. (2010) showed satisfactory fit for the climate measure. The reliability coefficients computed for the current study were .86 for mastery climate and .70 for performance climate.

Sport ability beliefs. The Conceptions of the Nature of Athletic Ability Questionnaire-2 (CNAAQ-2; Biddle et al., 2003) was employed to measure two sport ability beliefs: incremental sport belief and entity sport belief. The two beliefs distinguish between the sport ability that is thought to be relatively fixed (entity) and the sport ability that is changeable (incremental). There were six items for each subscale. The fit indices for the CFA of the CNAAQ-2 were acceptable and invariant across gender and age. The alpha coefficient for incremental was .85 and for entity was .76 for this study.

Enjoyment and effort. The enjoyment and effort subscales of the Intrinsic Motivation Inventory (IMI; McAuley, Duncan, & Tammen, 1989) were adapted to assess enjoyment (e.g., "I enjoy PE very much") and effort (e.g., "I usually put a lot of effort into PE"). Cronbach's alpha for enjoyment was .95 and for effort was .91 for the current study.

Intention to exercise during leisure time. Two items were used to measure intention to exercise during leisure time (Hagger et al., 2007; Wang et al., 2008). The students were asked whether they *planned* and *intended* to play sport or exercise three times a week for the next two weeks. All the responses of the above scales were given on 7-point scales ranging from 1 (strongly disagree or very unlikely) to 7 (strongly agree or very likely).

Data Analyses

We followed the steps outlined by previous studies (Marshall et al., 2002; Wang et al., 2006) in transforming each variable. All the seven sedentary behaviors and physical activity were polychotomised. This approach reduces the excessive skewness and leptokurtic distribution of the variables. The time spent on computer/internet, playing video games, doing homework, leisure reading (not for school), sitting and talking/listening to music, and talking on the telephone were put into four categories: None (0 hour/week), Low (0.1 to 2.9 hour/week), Moderate (3.0 to 6.9 hour/week), and High (≥ 7 hour/week). Television watching was also classified into four categories: None (0 hour/week), Low (0.1 to 6.9 hour/week), Moderate (7.0 to 13.9 hour/week), and High (≥ 14.0 hour/week). In addition, the levels of physical activity participation were recorded into four categories: No Activity or Inactive (0 min/week); Low Activity with 0-150 minutes of moderate activity (3 to 5.9 METs) and ≤ 60 minutes/week of vigorous activity (≥ 6 METs); Moderate Activity with either > 150 and ≤ 300 minutes/week of moderate activity or > 60 and ≤ 120 minutes/week of vigorous activity, and High Activity with either > 300 minutes/week of moderate activity or > 120 minutes/week of vigorous activity.

The polychoric correlations of all the sedentary and physical activities were computed. We conducted Chi square tests of independence to examine the differences by gender and age among sedentary and physical activities. Finally, separate simultaneous regression analyses were conducted to examine predictors of physical activity intention using sport ability beliefs, achievement goals, perceived motivational climate, and enjoyment in PE for the primary, secondary, and junior college students and the two genders.

Results

Table 1 shows the prevalence of sedentary and physical activity behaviors among the overall sample, males, and females and the three age levels for the seven types of sedentary activity. Table 2 shows the frequency distribution of physical activity participation.

Table 1. ***Percentage of Students with Different Prevalence of Sedentary Behaviors by Gender and School Level***

Category	None (0 hr/wk)	Low (0.1-2.9 hr/wk)	Medoerate (3-6.9 hr/wk)	High (≥ 7 hr/wk)
Computer/Internet				
Overall	23.2	22.8	20.9	33.1
Boys	22.1	19.4	21.5	37.1
Girls	23.6	24.9	20.6	30.9
Primary	23.9	32.3	21.0	22.8
Secondary	22.3	15.7	21.3	40.7
Junior College	23.8	13.9	19.4	42.9
Video Games				
Overall	73.3	12.0	6.5	8.3
Boys	56.7	15.9	11.0	16.5
Girls	84.6	9.1	3.2	3.0
Primary	64.9	18.1	8.2	8.8
Secondary	78.7	7.2	5.4	8.6
Junior College	83.9	6.9	4.2	5.0
Homework				
Overall	21.2	11.0	16.8	51.0
Boys	27.9	11.8	17.6	42.8
Girls	16.6	10.3	16.0	57.1
Primary	19.6	14.9	18.4	47.1
Secondary	23.2	8.9	17.2	50.7
Junior College	19.9	4.7	9.7	65.8
Leisure Reading				
Overall	55.2	22.3	12.1	10.4
Boys	66.5	18.0	9.0	6.5
Girls	47.7	25.2	14.2	12.9
Primary	48.7	25.5	13.7	12.0
Secondary	59.1	20.5	10.7	9.7
Junior College	64.5	17.1	11.2	7.2
Sit & Talk				
Overall	41.7	22.0	13.4	22.8
Boys	56.0	16.9	9.7	17.4
Girls	32.7	25.0	15.8	26.6
Primary	47.6	27.6	10.6	14.2
Secondary	35.2	18.0	15.4	30.4
Junior College	40.7	16.4	16.4	26.6
Telephone				
Overall	47.7	34.1	9.9	8.3
Boys	60.6	26.7	6.9	5.8
Girls	39.3	38.6	11.9	10.2
Primary	44.6	41.0	8.5	5.9
Secondary	47.3	29.6	11.5	11.6
Junior College	60.5	25.1	9.2	5.2
TV Watching				
Overall	25.2	12.7	15.3	46.8
Boys	31.0	12.1	13.5	43.5
Girls	21.3	12.8	16.6	49.3
Primary	22.6	15.5	16.4	45.4
Secondary	25.3	9.7	14.1	50.9
Junior College	33.7	13.4	15.9	37.0

Note. For TV Watching, None means 0 hour/week, Low means 0.1-6.9 hours/week, Moderate means 7-13.9 hours/week, and High means ≥ 14 hours/week.

Table 2. ***Percentage of Students with Different Physical Activity Levels by Gender and School Level***

Group	Inactive[a]	Low[b]	Moderate[c]	High[d]
Overall	4.6	17.1	18.7	59.6
Boys	4.9	11.8	15.0	68.3
Girls	4.3	20.7	21.5	53.5
Primary	2.9	12.0	16.8	68.2
Secondary	5.2	19.3	19.9	55.6
Junior College	8.4	27.5	21.3	42.7

[a]0 minutes/week. [b]≤ 150 minutes/week of moderate activity and ≤ 60 minutes/week of vigorous activity. [c]> 150 and ≤ 300 minutes/week of moderate activity or > 60 and ≤ 120 minutes/week of vigorous activity. [d]> 300 minutes/week of moderate activity or > 120 minutes/week of vigorous activity.

Sedentary Behaviors

Computer/Internet. In general, the majority of Singaporean students spent more than three hours per week on a computer / internet. The results of the Chi-square tests showed that there were significant gender differences in the use of computer ($\chi^2_{(3)} = 19.95$, $p < .001$). Specifically, male students tended to spend more time on a computer and/or internet compared to female students. As age increased, the time spent using a computer and internet also increased ($\chi^2_{(6)} = 188.41$, $p < .001$).

Video games. In terms of video gaming, 73.3% of the students reported 0 hour/week on video gaming. Regarding students who did participate, male students tended to spend significantly more time in playing video games compared to their female counterparts ($\chi^2_{(3)} = 348.57$, $p < .001$). Primary school students reported higher playing time compared to secondary and junior college students ($\chi^2_{(6)} = 125.88$, $p < .001$).

Homework. Doing homework appeared to be the highest sedentary activity that the students participated in. More than half of the students spent seven hours or more per week doing their homework. Girls spent significantly more time on homework than boys ($\chi^2_{(3)} = 79.21$, $p < .001$). The junior college students spent more time doing homework compared to the secondary and primary school students ($\chi^2_{(6)} = 81.41$, $p < .001$).

Leisure reading. The majority of Singaporean students in this study did not read a great deal outside of their textbooks. More than half of the students reported zero hour/week reading books, magazines, and newspapers. Female students tended to spend significantly more time reading compared to their male counterparts ($\chi^2_{(3)} = 113.69$, $p < .001$). Primary school students reported higher reading time compared to secondary and college students ($\chi^2_{(6)} = 49.42$, $p < .001$).

Sitting and talking to friends. In terms of sitting down and talking to friends, the majority of Singaporean students spent less than three hours per week. However, the results of the Chi-square tests showed that there were significant gender differences ($\chi^2_{(3)} = 171.10$, $p < .001$), with female students spending more time sitting and talking to friends than males. In addition, secondary school students spent more time sitting and talking to friends than primary and junior college students did ($\chi^2_{(6)} = 161.46$, $p < .001$).

Use of the telephone. Most Singaporean students did not spend too much time on the telephone (less than three hours per week). Female students tended to spend more time talking on the phone than their male counterparts ($\chi^2_{(3)} = 140.79$, $p < .001$). In

addition, junior college students appeared to spend less time on the telephone, compared to secondary and primary school students ($\chi^2_{(6)} = 93.33$, $p < .001$).

TV watching. Nearly half of the students (46.8%) spent 14 hours or more per week watching TV. Female students tended to watch more TV than male students ($\chi^2_{(3)} = 39.32$, $p < .001$). In addition, secondary and primary school students appeared to spend more time than junior college students in TV watching ($\chi^2_{(6)} = 51.83$, $p < .001$).

Physical Activity

Overall, about 60% of the students reported a high amount of physical activity (> 300 minutes/week of moderate activity or > 120 minutes/week of vigorous activity). About 22% of the students reported low or no physical activity. Boys were more active than girls ($\chi^2_{(3)} = 80.44$, $p < .001$). The decreasing trend of physical activity participation from primary, secondary, to junior college was obvious ($\chi^2_{(6)} = 121.87$, $p < .001$). That is, as the students grew older, their amount of physical activity participation dropped.

Polychoric Correlations

Table 3 presents the results of the polychoric correlations. The results show that the use of a computer/internet had positive but weak significant relationships with all other items. Video gaming was positively associated with television watching, use of the telephone, and physical activity. Weak and positive associations were also found between homework and leisure reading, sit and talk, use of telephone, and television watching. Leisure reading was related to sit and talk, and telephone use. Use of the telephone was also related to television watching. Physical activity participation had positive but weak relationships with computer/internet, video gaming, sit and talk, and use of the telephone.

Table 3. ***Polychoric Correlation Matrix for the Sedentary Behaviors and Physical Activity***

Variables	1	2	3	4	5	6	7	8
1. Computer/internet	1.00							
2. Video Games	.26**	1.00						
3. Homework	.16**	-.04	1.00					
4. Leisure Reading	.12**	-.01	.23**	1.00				
5. Sit & Talk	.21**	.04	.21**	.26**	1.00			
6. Telephone	.27**	.10**	.15**	.15**	.31**	1.00		
7. TV Watching	.23**	.22**	.18**	.08*	.20**	.17**	1.00	
8. Physical Activity	.11**	.12**	.06	.06	.10**	.12**	.03	1.00

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

Predictors of Physical Activity Intention

Separate and simultaneous regression analyses were conducted to examine predictors of physical activity intention using sport ability beliefs, achievement goals, perceived motivational climate, and enjoyment in PE for the primary, secondary, and junior college students and the two genders. The predictors were entered in steps with enjoyment in PE first, followed by perceptions of climate, sport ability beliefs, and achievement goals. The results of these analyses are shown in Table 4.

Table 4. ***Predictors of Physical Activity Intention by School Level***

	Primary					Secondary					Junior College				
	B	SE B	β	t	R^2	B	SE B	β	t	R^2	B	SE B	β	t	R^2
Step 1															
Enjoyment	.30	.02	.31	12.58**	.10	.31	.02	.34	13.71**	.11	.28	.05	.29	5.97**	.08
Step 2															
Enjoyment	.27	.03	.29	10.08**		.26	.03	.28	9.66**		.30	.05	.30	5.53**	
Mastery Climate	.06	.03	.05	1.97		.14	.04	.10	3.56**		-.05	.09	-.03	-.50	
Perfa Climate	.10	.03	.08	3.42**	.11	.09	.04	.06	2.37*	.13	.08	.08	.05	.97	.08
Step 3															
Enjoyment	.18	.03	.19	6.49**		.19	.03	.21	7.00**		.20	.05	.20	3.58**	
Mastery Climate	-.05	.03	-.04	-1.32		.03	.04	.03	.85		- .12	.09	-.07	-1.29	
Perf Climate	.11	.03	.10	3.85**		.11	.04	.08	3.05**		.12	.08	.07	1.44	
Incremental	.31	.04	.26	8.44**		.26	.04	.20	6.68**		.36	.08	.23	4.25**	
Entity	-.11	.03	-.10	-3.78**	.16	-.16	.03	-.13	- 5.06**	.17	-.12	.07	-.09	-1.80	.14
Step 4															
Enjoyment	.13	.03	.14	4.47**		.12	.03	.13	3.81**		.09	.06	.09	1.45	
Mastery Climate	-.07	.03	-.06	-1.94		.02	.04	.02	.59		-.15	.09	-.09	-1.58	
Perf Climate	.08	.03	.07	2.73**		.07	.04	.05	1.79		.07	.08	.04	.89	
Incremental	.24	.04	.20	6.18**		.20	.04	.15	4.83**		.28	.09	.18	3.21**	
Entity	-.12	.03	-.11	-4.19**		-.16	.03	-.13	- 5.07**		-.12	.07	-.09	-1.72	
Perf- Approach	.09	.02	.11	3.70**		.10	.03	.09	2.87**		.08	.08	.07	1.08	
Mastery-Approach	.14	.04	.13	3.42**		.17	.04	.15	3.89**		.17	.10	.13	1.59	
Perf-Avoidance	-.06	.03	-.06	-2.13*		-.04	.03	-.03	-1.13		-.02	.07	-.02	-.32	
Mastery-Avoidance	.02	.03	.02	.74	.18	-.02	.04	-.02	-.59	.19	.06	.09	.05	.70	.16

[a]Performance.
* $p < .05$. ** $p < .01$.

For the primary school students, intention to participate in physical activity during leisure time was positively predicted by enjoyment, perceived performance climate, incremental beliefs, and approach achievement goals (mastery and performance), and negatively predicted by entity beliefs and performance-avoidance goals. The model explained 18% of the variance in intention.

Among the secondary school students, similar predictors were found; that is, enjoyment in PE, incremental beliefs, and approach achievement goals positively predicted physical activity intention, and entity beliefs negatively predicted the intention. The overall model predicted 19% of the variance in intention to participate in physical activity in the next two weeks. For the junior college students, incremental belief was the only positive and significant predictor of the intention in the final step, although enjoyment in PE was a positive predictor in the previous three steps. Sixteen percent of the variance in the intention was predicted in this model.

In terms of the two genders, enjoyment, mastery and performance approach goals, and incremental beliefs positively predicted physical activity intention, and entity beliefs negatively predicted the intention. Performance climate was a positive predictor for male students only. The total variance accounted for in the intention for boys and girls were 16% and 24%, respectively (Table 5).

Taken together, it seems that enjoyment in PE and sport ability beliefs were consistent and appeared to be strong predictors of physical activity intention among all the three age groups of students. The approach achievement goals were important predictors of the intention only for the secondary and primary students. The performance climate positively predicted the intention to be physically active only among primary school students and male students.

Discussion

Physical activity and sedentary activity are closely related to health and risk factors (Ekelund et al., 2006; Stensel, Gorely, & Biddle, 2008). From a psychological viewpoint, it is important to understand psychological correlates of physical activity so that possible intervention strategies can be designed to suit different target groups with specific motivational and physical activity profiles. The main purpose of the present study was to examine the sedentary behavior and physical activity patterns and correlates of physical activity for Singaporean school students in primary school, secondary school, and junior college.

The present study echoed the findings of previous research in that young people across all age groups participate in a variety of physical activities as well as sedentary activities. Physical activity participation is an important part of leisure time in this sample with almost 60% of the students participating in physical activity for more than 300 minutes of moderate to vigorous activity or more than 120 minutes of vigorous activity per week. This result is aligned to an earlier study by Wang et al. (2006) with Singapore children aged between 10 to 14 years old. In addition, Singaporean students also spent a significant amount of time doing homework (more than 50% spent more than seven hours/week). It is important to note on this issue that the sedentary behavior of homework may be highly valued, yet it is equally problematic for health if it contributes to excessive sitting time.

The third sedentary activity in which Singaporean youth spent

Table 5. ***Predicators of Physical Activity Intention by Gender***

	Male					Female				
	B	SE B	β	t	R^2	B	SE B	β	t	R^2
Step 1										
Enjoyment	.30	.02	.32	11.82**	.10	.35	.02	.40	19.43**	.16
Step 2										
Enjoyment	.26	.03	.28	8.65**		.32	.02	.36	14.78**	
Mastery Climate	.10	.04	.08	2.48*		.10	.03	.08	3.09**	
Perfa Climate	.08	.04	.06	2.27*	.11	.06	.03	.04	1.98*	.17
Step 3										
Enjoyment	.19	.03	.20	6.10**		.23	.02	.26	10.37**	
Mastery Climate	.00	.04	.00	.05		-.02	.03	-.01	- .48	
Perf Climate	.11	.04	.08	3.03**		.08	.03	.06	2.76**	
Incremental	.26	.04	.20	6.04**		.33	.03	.25	10.13**	
Entity	.14	.03	-.12	-4.48**	.15	-.12	.03	-.10	- 4.53**	.22
Step 4										
Enjoyment	.14	.03	.15	4.35**		.15	.03	.17	5.87**	
Mastery Climate	- .02	.04	- .01	- .34		.04	.03	- .03	- 1.34	
Perf Climate	.08	.04	.06	2.04*		.05	.03	.04	1.67	
Incremental	.20	.05	.15	4.37**		.25	.03	.19	7.18**	
Entity	-.15	.03	- .13	- 4.43**		.13	.03	- .11	- 5.00**	
Perf- Approach	.08	.03	.09	2.58**		.07	.02	.07	2.94**	
Mastery-Approach	.13	.05	.11	2.73**		.19	.04	.17	5.12**	
Perf-Avoidance	-.03	.03	- .03	-1.00		.02	.03	- .02	- .86	
Mastery-Avoidance	-.02	.03	- .02	- .53	.16	.02	.03	.02	.90	.24

[a]Performance.
* $p < .05$. ** $p < .01$.

most of their time was the use of a computer and/or internet, after television watching and homework. This is unsurprising and often a major cause for concern, particularly if the time spent in such behaviors is for recreational gaming. This kind of sedentary behavior has increased greatly in recent years and is likely to increase continuously.

We hypothesized that boys and girls across all age groups would have different patterns of sedentary and physical activity. The results of the present study support this hypothesis. In terms of physical activity patterns, boys are more active than girls across all ages, supporting the extant literature (Caspersen, Pereira, & Curran, 2000). In terms of sedentary activity, there are significant gender differences across all types of activities. Boys tend to engage more in using a computer/internet and video games, and girls spend more time doing homework, reading, sitting and talking, using the telephone, and watching television. The findings are similar to Wang et al.'s (2006) earlier study as well as UK data (Gorely, Biddle, Marshall, & Cameron, 2009). However, with the younger age group, Wang et al. found that 20% of boys and 24% of the girls watched more than two hours of TV per day, whereas the present study found that 43.5% of boys and 49.3% of girls spent more than two hours per day watching TV. There is an upward trend in watching TV and this could be due to the fact that there has been an increase in cable and digital TV providers and services in Singapore. Cable television has gained great acceptance in the last few years and the proportion of subscriptions to cable television has surged from 14% in 1998 to about 58% in 2008 in Singapore households (Department of Statistics, 2009). In addition, the use of a computer/internet has also increased among the younger age group compared to findings of previous studies. This is not surprising as Singapore is at the forefront in the use of IT in schools (Ministry of Education, 2009) and availability of computer-based entertainment has increased.

Our second hypothesis was that the patterns of sedentary and physical activity participation would differ among the three age groups. Literature indicates that participation in all types of physical activity declines strikingly as age or grade increases (Sallis, 2000; Sallis et al., 1992). Our findings are consistent with the literature. Although the junior college students demonstrated the lowest physical activity level in this study, the majority of them still engaged in moderate to vigorous intensity activity outside of PE classes. Previous studies (e.g., Myers et al., 1996; Nelson, Gordon-Larsen, Adair, & Popkin, 2005) suggest that during the transition from adolescence to young adulthood, the magnitude of decline in physical activity may depend on several factors. One of these factors could be the type of sport involved. For example, skaters have the greatest decline in skating participation once they reach adulthood. Also physical activity and sedentary behaviors are not inversely related in this study. This finding replicates a previous study done in Singapore (Wang et al., 2006) as well as data from the UK and the USA (Marshall et al., 2002).

Researchers have recognised the importance of psychological factors in influencing physical activity participation, but very few studies have used a theoretical framework in understanding motives in physical activity participation. Sallis, Prochaska and Taylor (2000) suggest that psychological variables such as perceived ability, beliefs system, and perceived support are consistently associated with physical activity participation. Wang et al. (2006) used three theoretical frameworks of achievement goal theory, self-determination theory, and sport ability beliefs and found that there were homogenous groups of children with distinct characteristics in psychological variables that differentiated the amount of physical activity. The present study has yielded the findings that the predictors of physical activity intention are different for the three age groups but are similar among two genders.

There are implications of the current findings. First, any formal or informal physical activity interventions should focus on reduction of multiple sedentary behaviors and not just focusing on one or two of them. Second, a program focusing on reduction of sedentary behaviors may not necessarily increase physical activity levels, because there is not an inverse relationship between physical activity and sedentary behavior. They are largely independent constructs, each requiring intervention. Third, the intervention programs need to be gender and age-specific.

Taken together, the findings of the present study highlight the need for practitioners such as physical educators, coaches, public health staff, and policy makers to consider gender and age-specific physical activity intervention programs aimed at reducing multiple sedentary behaviors and increasing physical activity. While there are multiple psychological predictors that may increase physical activity intention, the findings in this point to the importance of enjoyment of physical activity, cultivating an incremental belief, and promotion of mastery climate and approach achievement goals.

References

Biddle, S. J. H., Wang, C. K. J., Chatzisarantis, N. L. D., & Spray, C. M. (2003). Motivation for physical activity in young people: Entity and incremental beliefs concerning athletic ability. *Journal of Sports Sciences, 21*, 973-989.

Bouchard, C., Blair, S. N., & Haskell, W. L. (Eds.). (2007). *Physical activity and health.* Champaign, IL: Human Kinetics.

Bouchard, C., & Katzmarzyk, P. T. (Eds.). (2010). *Physical activity and obesity* (2nd ed.). Champaign, IL: Human Kinetics.

Caspersen, C. J., Pereira, M. A., & Curran, K. M. (2000). Changes in physical activity patterns in the United States, by sex and cross-sectional age. *Medicine and Science in Sports and Exercise, 32*, 1601-1609.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Department of Statistics. (2009). *Yearbook of Statistics Singapore*. Singapore: Ministry of Trade and Industry.

Ekelund, U., Brage, S., Froberg, K., Harro, M., Anderssen, S. A., & Sardinha, L. B. (2006). TV viewing and physical activity are independently associated with metabolic risk in children: The European Youth Heart Study. *Public Library of Science Medicine, 2*(12), 2449-2456.

Gorely, T., Biddle, S. J. H., Marshall, S. J., & Cameron, N. (2009). The prevalence of leisure time sedentary behavior and physical activity in adolescent boys: An ecological momentary assessment approach. *International Journal of Pediatric Obesity.* doi: 10.1080/17477160902811181.

Gorely, T., Marshall, S. J., Biddle, S. J. H., & Cameron, N. (2007). Patterns of sedentary behavior and physical activity among adolescents in the United Kingdom: Project STIL. *Journal of Behavioral Medicine, 30*, 521-531.

Hagberg, J. M. (1990). Exercise, fitness, and hypertension. In C. Bouchard, R. J. Shephard, T. Stephens, J. R. Sutton & B. D. McPherson (Eds.), *Exercise, fitness, and health: A consensus of current knowledge* (pp. 455-466). Champaign, IL: Human Kinetics Publishers.

Hagger, M. S., Chatzisarantis, N. L. D., Barkoukis, V., Wang, C. K. J., Hein, V., Pihu, M. (2007). Cross-cultural generalizability of the theory of planned behavior among young people in a physical activity context. *Journal of Sport & Exercise Psychology, 29*, 2-20.

Hardman, A. E., & Stensel, D. J. (2009). P*hysical activity and health: The evidence explained* (2nd ed.). London: Routledge.

Lee, I. M., Paffenbarger, R. S. J., & Hsieh, C. (1991). Physical activity and risk of developing colorectal cancer among college alumni. *Journal of National Cancer Institute, 83*, 1324-1329.

Marsh, H. W., Papaioannou, A., Martin, A. J., & Theodorakis, Y. (2006). Motivational constructs in Greek physical education classes: Factor structure, gender and age effects in a nationally representative longitudinal sample. *International Journal of Sport and Exercise Psychology, 4*, 121-148.

Marshall, S. J., Biddle, S. J. H., Sallis, J. F., Mckenzie, T. L., & Conway, T. L. (2002). Clustering of sedentary behaviors and physical activity among youth: A cross-national study. *Pediatric Exercise Science, 14*, 401-417.

McAuley, E., Duncan, T. E., & Tammen, V. V. (1989). Psychometric properties of the Intrinsic Motivation Inventory in a competitive sport setting: A confirmatory factor analysis. *Research Quarterly for Exercise and Sport, 60*, 48-58.

Ministry of Education. (2009). *Microsoft, MOE and IDA Embark on BackPackLive!* Ministry of Education, Singapore. Retrieved from http://www.moe.gov.sg/media/press/2009/07/backpacklive.php

Ministry of Health, S. (2005). *National Health Survey 2004*. Singapore: Ministry of Health, Singapore.

Myers, L., Strikmiller, P. K., Webber, L. S., & Berensen, G. S. (1996). Physical and sedentary activity in school grades 5-8: The Bogalusa Heart Study. *Medicine & Science in Sports and Exercise, 28*, 852-859.

Nelson, M. C., Gordon-Larsen, P., Adair, L., & Popkin, B. M. (2005). Adolescent physical activity and sedentary behavior. *American Journal of Preventive Medicine, 28*(3), 259-266.

Pate, R. R., Pratt, M., Blair, S. N., Haskell, W. L., Macera, C. A., Bouchard, C. (1995). Physical activity and public health: A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *Journal of American Medical Association, 273*, 402-407.

Powell, K. E., Thompson, P. D., Caspersen, C. J., & Kendrick, J. S. (1987). Physical activity and the incidence of coronary heart disease. *Annual Reveiw of Public Health, 8*, 253-287.

Sallis, J. F. (2000). Age-related decline in physical activity: A synthesis of human and animal studies. *Medicine & Science in Sports and Exercise, 32*, 1598-1600.

Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents. *Medicine and Science in Sports and Exercise, 32*, 963-975.

Sallis, J. F., Simons-Morton, B. G., Stone, E. J., Corbin, C. B., Epstein, L. H., Faucette, N. (1992). Determinants of physical activity and interventions in youth. *Medicine and Science in Sports and Exercise, 24*(6, Suppl.), S248-S257.

Sallis, J. F., Strikmiller, P. K., Harsha, D., & Feldman, H. A. (1996). Validation of interviewer- and self-administered physical activity checklists for fifth grade students. *Medicine and Science in Sports and Exercise, 28*, 840-851.

Stensel, D. J., Gorely, T., & Biddle, S. J. H. (2008). Youth health outcomes. In A. L. Smith & S. J. H. Biddle (Eds.), *Youth physical activity and sedentary behavior: Challenges and solutions* (pp. 31-57). Champaign, IL: Human Kinetics.

Vandewater, E. A., Shim, A., & Caplovitz, A. G. (2004). Linking obesity and activity level with children's television and video game use. *Journal of Adolescence, 27*, 71-85.

Wang, C. K. J., Biddle, S. J. H., & Elliot, A. J. (2007). The 2x2 achievement goal framework in a physical education context. *Psychology of Sport and Exercise, 8*, 147-168.

Wang, C. K. J., Chia, M., Quek, J. J., & Liu, W. C. (2006). Patterns of physical activity, sedentary behaviors and psychological determinants among Singaporean school children. *International Journal of Sport & Exercise Psychology, 4*, 227-249

Wang, C. K. J., Lim, B. S. C., Aplin, N. G., Chia, M., McNeill, M., & Tan, W. K. C. (2008). Students' perceived purposes of physical education in Singapore: Perspectives from a 2 x 2 achievement goals framework. *European Physical Education Review, 14*, 51-70.

Wang, C. K. J., Liu, W. C., Chatzisarantis, N. L. D., & Lim, B. S. C. (2010). Influence of perceived motivational climate on achievement goals in physical education: A structural equation mixture modeling analysis. *Journal of Sport and Exercise Psychology, 32*, 324-338.

World Health Organisation. (2008). *World Health Statistics 2008*. Geneva, Switzerland: World Health Organisation Press. ■

Effects of the Coordination Exercise Program on School Children's Agility: Short-Time Program during School Recess

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Abstract

This study examined the impact of a short-time coordination program conducted during recess periods on improving agility in elementary school students. The subjects consisted of 60 third grade students, who were randomly assigned to an experimental group (n = 29) and a control group (n = 31). The experimental group completed a coordination program intended to improve agility during 20-minute recesses, two to three times a week for five weeks, whereas the control group participated in usual activities such as mini soccer games and tag games during the recess. Repetitive side steps, an indicator of agility, were measured for both groups at the beginning and end of the intervention period. While the test scores indicated no difference between the two groups in the pretest, the posttest indicated a significant difference in the test scores in favor of the experimental group, t (59) = 2.90 and $p < .005$. The results indicated that the short-time coordination program can be effective in improving agility in elementary school students.

Keywords: fitness, elementary school students

Physical fitness among children has continued to decline for more than 30 years. Despite the large body of research on physical fitness in children (Seki, 2009; Suzuki, 2008; Suzuki, Nishijima, & Suzuki, 2010) and improvement programs proposed (Azumane & Miyashita, 2004; Azumane, Otomo, Harada, Isaka, & Takeo, 2006; National Recreation Association in Japan [NRAJ], 2006), fitness is still seen as a problem today in Japan. A study in 2008 of physical fitness and ability showed that Japanese children's fitness today remained low compared to findings from 1985 (Ministry of Education, Culture, Sports, Science and Technology [MECSST], 2008). Hibino (2004) indicated that a lack of activity and an inappropriate lifestyle will lead to health issues such as obesity and lifestyle diseases, and have adverse psychological effects such as a lack of ambition and willpower. Although some improvement programs have been proposed, they are considered too lengthy and inappropriate for children who are not good at sports or have little interest in sports.

One concern is the deterioration in coordination and agility among children. The Lifelong Sports Division of the MECSST has reported deterioration in coordination and the ability to move quickly among children who are "unable to run in a straight line or evade a ball to avoid injury", stating that "even though the standards could not decrease any further, they are still at a dangerous level" (Yomiuri, 2007, p. 1). While there are studies reporting on the distribution of activities during recess (Senda, 2004) and observational studies on play activities (Choh, Senda, Ono, & Naka, 2004; Fukutomi & Abiru, 1968; Senda & Inoue, 2004), there have been no proposals or research addressing promoting coordination and agility of children in Japan.

Taking this situation into account, we based our research on the coordination theories of the Russian physiologist Bernstein (1996), and focused on agility, an aspect of coordination which comprises skill and quickness (Meinel, 1960, 1981). Agility is defined as the speed to change one's physical position and the direction of movement (Clarke, 1977) and react to a stimulus, start quickly and efficiently, move in the correct direction, and be ready to change direction or stop quickly to make a play in a fast, smooth, efficient, and repeatable manner (Verstegen & Marcello, 2001). Agility is known as a performance-related fitness component (Hatano, 2009), and it has been demonstrated to provide an impact on children's health. In Japan, accidents and injuries resulting from poor agility in children have frequently been reported, such as accidents caused by colliding with other students, being unable to dodge a ball or use their hands when falling (National Agency for the Advancement of Sports and Health [NAASH], 2010). Improvement in agility can prevent daily injuries and accidents in elementary school students and thus will lead to a safer, healthier everyday life.

Coordination is the integrative action of the nervous system as described by Sherrington, which is "when a movement is initiated by an individual, with a fixed intention and a fixed objective, that movement achieves its objective" (Yamamoto, Yabe, & Ikai, 1972, p. 41). The ability to perform voluntary movement comprises coordination, equilibrium, agility and flexibility (Hirohashi & Kanehara, 1977). Further, Hartmann and Minow (2008) describe coordination ability as the ability to move the body skillfully, a prerequisite for athletic performance. Coordination ability is related to rhythm skills, balance skills, transformation skills, reaction skills, consolidation skills, orientation skills and recognition skills. In this study, we focused on the agility aspect of coordination and aimed to examine the impact of a coordination exercise program during recess on improving the agility of elementary school students.

According to Meinel (1981, p. 247), "Children regularly play with objects and use sporting equipment, refining and correcting their hand-eye coordination and the coordination between peripheral stimuli and movements, making them particularly suitable subjects." Gallahue (1999) also describes the use of sporting equipment as a contributing factor in the development of athletic skills. In view of this, this study used equipment as part of a program held during recess in which students were required to move quickly. The hypothesis of the study was that the short-time coordination exercise program held during the recess would be effective in improving the agility level of elementary school students.

Method

Participants

The subjects of this study were 60 third-grade students aged 8-9

years from a public elementary school in Tokyo, Japan. The average height and weight of the participants were in line with the national average: 128.6 cm and 26.6 kg for females (national average 127.5 cm & 26.6 kg) and 130.1 cm and 28.5 kg for males (national average 128.2 cm & 27.3 kg). We held detailed discussions with the Board of Education and the principal of the school with regard to implementing this study, and prior to commencing our research, the principal gained the consent of the students' parents. The study was carried out with the approval of the ethics committee of the School of Health and Sports Science, Juntendo University.

Design of the Study

The study used a pretest and posttest with control group design. Of the 60 participants, nearly half of them (n = 29, 13 female and 16 male) were randomly assigned to an experiment group and the other half (15 female and 16 male) in the control group. A series of 20-minute recesses during the school day were used to implement the intervention and the study lasted for five weeks during a regular school semester. Immediately before and after the intervention, an agility test was administered to participants in both groups. The scores of the agility test was the dependent variable and compared between the two groups to determine the effectiveness of the intervention.

Intervention Procedure

There was a 20-minute recess period in each school day. Of the five recesses in a week, two to three recesses were used for the intervention, resulting in a total of 12 intervention recesses during the five weeks of the study. The coordination intervention was the *Droutability* coordination exercise program developed by Yasumitsu (2007). The *Droutability* program involved the use of cross plates (24 cm × 24 cm) and different colored disks 15 cm in diameter (see Figure 1). A total of 16 cross plates and six sets of disks were randomly placed on one half of the gymnasium floor (15 m × 15 m). Each set of disks contained nine different colored disks with painted numbers from 1 to 9, resulting in 54 disks in total (Figure 1).

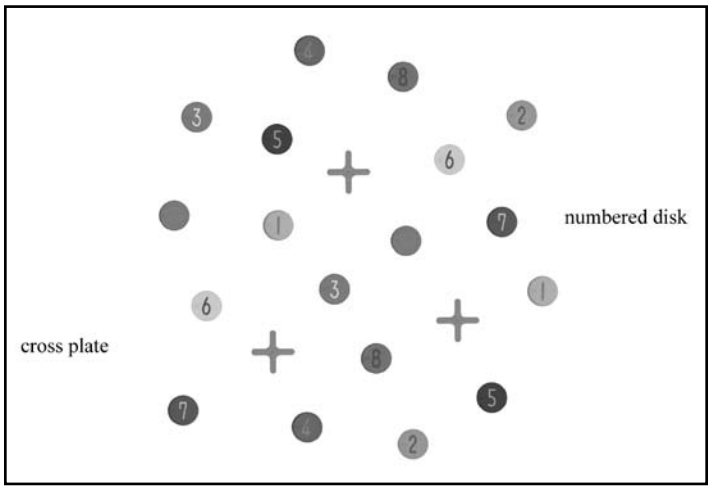

Figure 1. Configuration of cross plates and numbered disks. Sixteen cross plates and six sets of numbered and colored disks (54 disks in total) were randomly placed on half of the gymnasium floor (15 m × 15 m).

During the intervention recess, the intervention group was evenly divided into two subgroups. The two subgroups continuously took turns to participate in a 30-second intervention activity in an alternate manner. That is, while one subgroup participated in the intervention activity, the other subgroup observed and rested, then the two subgroups shifted activities, and so forth. When the intervention activity began, students ran to a cross plate of their choice and stepped backwards and forwards over the cross plate as quickly as possible without touching the plate. Then a command was given to ask students to reach a disk with a specific color or number. For example, if the command was "red", the student would move to the nearest red disk, touch it with a foot, and then quickly return to his/her original cross plate to resume stepping action over the cross plate.

During the 30-second intervention activity period, the students continuously moved around in all directions in search of the disk with designated colors or numbers and repeated the activity described above in response to the command. Also, the students were asked to move as swiftly as possible and to avoid collision with their classmates. The students in the experiment group participated in four sets of 30-second intervention activity in each intervention recess. The control group took part in usual recess activities such as mini soccer games and tag games during the recess. The students of the experimental group also participated in usual recess activities three to two days/week during recesses without receiving intervention in addition to participating in the intervention activities two to three days/week during recesses.

Measurement of the Agility

On the first and final days of the study, all participants took part in a physical test battery of *repetitive side steps* as a measure of agility. The physical battery of repetitive side steps was adopted by the MECSST (aimed at 6-11 year olds) - a Japanese version of the side step test in the California Physical Performance Test. Before the start of the repetitive side steps test, students stood over a center line facing the same direction. When the command "start" was given, they began to take side steps (not a jump) to touch or cross over the line on the right, then return to the center line and side step to touch or cross the line on the left (see Figure 2). This motion was repeated for 20 seconds and one point was given for each line they passed (e.g., right center left center would make four points). This test was conducted twice at the pretest and twice at the posttest; the better score was recorded for each.

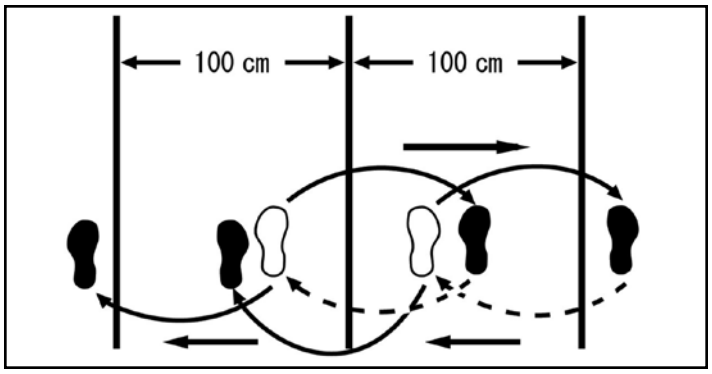

Figure 2. Movement Direction and Pattern of the Repetitive Side Steps.

We had the students form two lines to complete the repetitive side steps and each line had seven to eight students, enabling us to take measurements for a total of 14-16 students simultaneously at a time. To accurately record the score, we used the same method as described in the MECSST guideline that the students were put into pairs, counted the number of steps their partner passed, and recorded the score in the result sheet.

The repetitive side steps test used in the study was one of the new physical test batteries (2008) currently used by the MECSST, and it is an accepted way to measure the agility aspect of coordination (Hirohashi & Kanehara, 1977; Seki, 2009; Suzuki et al., 2010). The coordination field tests (Kuroki & Mizuta, 1997) of the Sports Science Center in Japan established by a coordination specialist committee also included the repetitive side steps as a test of agility. In view of this, the repetitive side steps test can be seen as an effective measuring test.

Data Analysis

A *t*-test was used to compare the results of the repetitive side steps between the two groups at the pretest and the posttest. SPSS version 18 was employed for the data analysis and the level of significance was set at 5%.

Results

The means (with standard deviations in parentheses) for the repetitive side steps scores at the pretest were 31.62 (6.04) for the experimental group and 32.87 (4.08) for the control group, with the control group's score a little bit better than that in the experimental group. The t test results indicated no differences between the two groups, with t (58) = 0.95, $p > .10$. After the intervention, the scores of the repetitive side steps were 35.69 (7.24) for the experimental group and 32.87 (5.73) for the control group. The differences between the two groups were statistically significant in favor of the experiment group, with t (59) = 2.90, $p < .005$.

Discussion

This study examined whether a short-time coordination exercise program held during recess would improve the agility of elementary school students. The experimental group participated in a coordination exercise program for a total of 12, 20-minute recesses in a five week period, whereas the control group did usual recess activities such as soccer and tag during the recess. The results support the hypothesis that a short-time coordination exercise program held during recess can be effective in improving the agility level of elementary school students.

Participating in the *Droutability* coordination exercise program might improve participants' ability to quickly change directions in response to conditions or commands. For example, when the children were performing the coordination exercise and on the verge of colliding, they had to make quick decisions and movements to avoid each other. Also, it is likely an improvement occurred in the ability to identify one's position and where to move, a so-called orientation ability and conversion ability, as indicated by Hartmann and Senf (2008). It turns out that all this improvement in coordination contributed to the improved agility reflected by the repetitive side steps test.

In Japan, accidents and injuries resulting from low agility in children — accidents caused by colliding with other students and being unable to dodge a ball or use their hands when falling — has been reported frequently (NAASH, 2010). Improvement in agility can help prevent everyday injuries and accidents in elementary school students, thus leading to safer, healthier everyday life.

Some similar studies have indicated that interventions can improve children's coordination and agility. Coordination research in Leipzig, Germany (Hartmann & Minow, 2008; Hartmann & Senf, 2008; Schnabel, Harre, & Krug, 2008) involved a program lasting 35-40 minutes per session. The coordination ability was measured before and after the program, and it was discovered that a coordination exercise program improved reaction skills. Other research projects on coordination in children (Azumane & Miyashita, 2004; Azumane et al., 2006; Rothlisberger, 2009) involved three weeks of 10-20 minute activities during regular physical education classes, and they reported positive changes in coordination and/or agility after the program. In addition, Azumane and Miyashita (2004) conducted a coordination exercise program on fourth grade elementary school students. The class average for repetitive side steps before the program was 32.2, while three weeks later it increased to 35.9. The results of this current study supported their findings.

In terms of the duration of programs, previous research does not differ from our research. However, most of the relevant studies discussed above were conducted in regular physical education classes without using a control group, whereas this study involved a control group and was conducted during recess rather than regular physical education classes. The implication is that effective use of the recess time also enables intervention to be carried out without disrupting regular physical education classes and produces significant results. The home room teacher and school principal commented that the program made effective use of time.

In our own as well as previous research studies, increased fitness scores suggest the effectiveness of the coordination exercise program. But in terms of the content of programs, it is not clear which method or activity could produce the most effective intervention. What is needed for further consideration is a comparative validation and analysis of each type of coordination exercise program and an investigation into creating the most efficient program.

In conclusion, this study confirms that a short-time coordination exercise program held during the school recess is effective in improving the agility of elementary school students. This suggests that by effectively using the recess period, physical fitness improvements can be made during the recess period. In addition, given the fact that the *Droutability* coordination exercise program just needs a short time to practice, it is convenient to practice it in elementary schools with limited time. Programs with a high element of gaming without losers like the *Droutability* allow all children to enjoy the activity and participate actively, including those children who do not like sports, hence improving children's physical fitness.

References

Azumane, A., & Miyashita, K. (2004). *More and more magical ways to get fit*. Tokyo, Japan: Shufu to Seikatsusha.

Azumane, A., Otomo, T., Harada, N., Isaka, M., & Takeo, Y. (2006). *Various sports coordination exercises* (2nd ed.). Nagoya, Japan:

Zenkoku Shoseki Shuppan.

Bernstein, N. A. (1996). *On the dexterity and its development*. In M. L. Latash & M. T. Turvey (Eds.), *Dexterity and its development* (pp. 9-244). Hillsdale, NJ: Lawrence Erlbaum Associates.

Choh, J. H., Senda, M., Ono, R., & Naka, A. (2004). Equipment seen from the playing activities in the kindergarten yard: Research into plans for public squares. *Landscape Research 67* (5), 429-432.

Clarke, H. H. (1977). *Application of measurement to health and physical education*. Tokyo, Japan: Baseball Magazine-Sha.

Fukutomi, H., & Abiru, T. (1968). Research into plans for landscape gardens in schools (1). *Chiba University Faculty of Horticulture Academic Report, 16,* 43-52.

Gallahue, D. L., & Sugihara, T. (1999). *Physical education for infants: A developmental approach*. Tokyo, Japan: Taishukan.

Hartmann, C., & Minow, H., J. (2008). *Sport verstehen — sport erleben teil 2: Trainingsmethodische grundlagen*. Leipzig, German: Freistaat Sachsen.

Hartmann, C., & Senf, G. (2008). *Sport verstehen — sport erleben teil 1: Sportmotorische grundlagen*. Leipzig, German: Freistaat Sachsen.

Hatano, Y. (2009). A brief historical review on the test and measurement studies in the United States during the period between 1861-1964 and its reflection to the Japan's counter-part on the selected topics. *Human Performance Measurement, 9*, 1-11.

Hibino, M. (2004). National initiatives towards physical development in children. *Children's Physical Growth and Development, 2*(5), 308-314.

Hirohashi, Y., & Kanehara, O. (1977). Fundamental research related to the development of coordination. *Research on Physical Education Studies, 22*(1), 27-36.

Kuroki, Y., & Mizuta, K. (1997). Research related to development of "coordination" in children and the young [Abstract]. *Japan Society of Physical Education, Health and Sports Sciences, 48*, 377.

Meinel, K. (1960). *Bewegungslehre*. Berlin, German: Volk und Wissen Vokseigener Verlag.

Meinel, K. (1981). *Meinel's sports studies*. Tokyo, Japan: Taishukan.

Ministry of Education, Culture, Sports, Science and Technology (2008). *2008 report on sports and fitness*. Tokyo, Japan: Japanese Government Printing Office.

National Agency for the Advancement of Sports and Health (2010). *Accidents which take place at school* (22). Tokyo, Japan: Author.

National Recreation Association in Japan (2006). *Aida aida*. Tokyo, Japan: NHK Educational.

Rothlisberger, M. M. E. (2009). Development and evaluation of a motor coordination training for children in special-needs classes. *Prax Kinderpsychol Kinderpsychiatr, 58*(3), 215-230.

Schnabel, Harre, & Krug, (2008). *Trainingslehre — trainingswissenschaft*. German: Meyer & Meyer Verlag, 300-307.

Seki, N. (2009). National initiatives on the decline of physical fitness in children: Initiatives on physical development and the changes in children. *Children's Physical Growth and Development, 7*(3), 171-175.

Senda, T. (2004). Research on improvements in the schoolyard based on a distribution diagram of recess activities at Sakata elementary school. *Landscape Research, 68*(5), 837-842.

Senda, T., & Inoue, S. (2004). Role of improvements in the schoolyard in the activities of the local and school community — example of plans for Sakata elementary school. *Landscape Research, 68*(1), 24-27.

Suzuki, H., Nishijima, N., & Suzuki, K. (2010). Improvements in basic lifestyle related to improvements in children's physical fitness: Investigation based on a three year tracking survey. *Growth and Development Research, 46*, 27-36.

Suzuki, K. (2008). Three year physical development plan for children and its effects. *Growth and Development Research, 37*, 68-76.

Verstegen, M., & Marcello, B. (2001). Agility and coordination. In B. Foran (Ed.), *High performance sports conditioning* (pp. 140-141). Champaign, IL: HumanKinetics.

Yamamoto, K., Yabe, K., & Ikai, T. (1972). Central coordination mechanism-1-voluntary movement and brain waves (Coordination [Special Edition]). *Physical Education Studies, 22*(1), 41-45.

Yasumitsu, T. (2007). *Stabilization official book*. Tokyo, Japan: PCY, Ltd.

Yasumitsu, T., & Nogawa, H. (2010). Effectiveness of a coordination exercise program during school recess of elementary school - Focusing on agility. *Research Society of Sports Performance, 2, 233-245*.

Yomiuri, S (2007). *Children's physical fitness - critical level*. Tokyo, Japan: Tokyo Head Office. ■

Multiculturalism in Teaching Physical Education: A Review of U.S. Based Literature

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Abstract

The purpose of this paper was to review extant literature on multicultural education in the context of teaching physical education. More specifically, the article was designed to review the literature on physical education teachers' knowledge and skills related to teaching culturally diverse students. The findings revealed teachers' knowledge and skills in multicultural education to embrace cultural competency, cultural sensitivity, culturally responsive pedagogy, and racial identity, and indicated multicultural education coursework and field experiences in teacher education programs to be important avenues for the development of positive attitudes toward cultural diversity. Other findings from this review point to limited previous research studies that focused on multiculturalism in physical education, and further that physical education teachers have varying degrees of knowledge and understanding of multicultural education. The outcomes of these studies underscore the important role physical education teacher education has in preparing pre-service teachers for diversity in schools.

Key Words: Multicultural education, Diversity, Teacher education

Background

There is an increasing diversity within the society of the United States, and hence student population in PreK-12 schools, requiring a cadre of teaching professionals who understand and respect diversity. Many countries, including the United States, Canada, Korea, Sweden, Holland, Australia, and France, face many challenges associated with the growing diverse student population (Allard & Santoro, 2008; Chang, 2008; Suarez-Orozco, 2005). For example, in the United States, immigrants from many different countries impact school public policy and curriculum (Rong & Preissle, 2009). The percentage of public school students who were White decreased from 68 to 55 percent between 1988 and 2008. During this period the percentage of Hispanic students doubled from 11 to 22 percent, and in 2008, Hispanic enrollment exceeded 10 million students (Aud, et al., 2010). This decrease maybe based on the greater use of private and home schooling, but it may also due to the growth in the number of Hispanic students, particularly in the West (Aud et al.).

Multicultural education is considered to be an "education that values diversity and includes the perspectives of a variety of cultural groups on a regular basis" (Santrock, 2001, p.171). The goal of multicultural education is to provide equal opportunities for all students through educational experiences that help them to become knowledgeable and respectful of others, making teachers' knowledge and skills extremely important. One of the major goals of multicultural education is to create, within schools and society, the democratic ideals that value justice, equality, and freedom (Banks, 2002). Influential teachers in multicultural education have a firm understanding of all cultures and this helps to ensure that each student receives an equal learning opportunity in the classroom setting (Sparks, Butt, & Pahnos., 1996).

However, scholars point to the widening gap between cultural and ethnic diversity of school children and their teachers (Burden, Hodge, & Harrison, 2004). For instance, the shortage of teachers of color and other teachers who desire to teach in urban school environments points to a crisis in U.S. education (American Association of College Teachers, 1994). Nelson-Barber and Mitchell (1992) explained that it is not only important to increase the number of qualified teachers of color but also to improve the preparation of teachers to help them meet the needs of students from all backgrounds. Matus (1999) disclosed that the lack of teacher education programs that prepare future teachers for teaching diverse learners in urban schools may contribute to the high rate of teacher attrition in urban schools. This points out the critical need for providing teachers with accurate and sufficient knowledge about their own culture and other cultures in educational institutions, helping to eradicate myths and stereotypes about racial and ethnic groups in the country (Sachs & Poole, 1989). Teachers should not only have knowledge of other cultures but also the desire to interact and communicate with students from diverse backgrounds and should possess necessary experiences and interests to teach (Chepyator-Thomson, You, & Russell, 2000; Fleming, Mitchell, & Gorecki, 1999; Sparks, et al., 1996). Further they should be encouraged to be sensitive to issues of race and multiculturalism and to consider learning about these issues as part of their educational responsibilities (Banks, 2002).

According to Chepyator-Thomson (2001), education with a multicultural perspective requires education professionals to start developing school programs that aid students' understanding of themselves and others, and that assist students in developing to their fullest potential. One way to provide teachers with new information on cultural differences is to implement diversity-based training programs for novice physical education teachers to experience teaching a diversity of learners, thereby preparing them with culturally relevant pedagogy (Hodge, 2003; Sparks, 1994). Another way is to have teacher educators develop coursework and learning experiences that help progress novice teachers from ethnocentric perspectives to ethnorelative values of intercultural sensitivity in meaningful ways (Burden, et al., 2004; DeSensi, 1995; Hodge, 2003) and to help them have a clear understanding and appreciation of the diverse ethnic and racial groups in the United States. It will not suffice for educators to have knowledge of culturally diverse learners yet be unable to recognize learners' individual and cultural needs and the complex relationship between culture and learning. A teacher's diverse knowledge base should include issues regarding race and ethnicity and the teacher should comprehend the implications for the teaching and learning process. Similarly, teachers must know and understand the ramifications of

racism, discrimination, prejudice, and injustice and what it means to be a diverse learner. Teachers need sufficient knowledge to be able to understand culturally different learners and to plan both developmentally and culturally appropriate instruction.

The purpose of this paper was to review extant literature on multicultural education in the context of teaching physical education. More specifically, the review the literature focused on pertained to physical education teachers' knowledge and skills in teaching culturally diverse students. The analytical perspectives derived from the literature centered on the following: (1) understanding multicultural education through concepts of assimilation and pluralism, (2) theoretical frameworks on teachers' knowledge and skills in multicultural education, (3) multicultural education in the context of teaching in physical education, and (4) multiculturalism in the context of curriculum in physical education.

Understanding Multicultural Education through Concepts of Assimilation and Pluralism

Overall, two theoretical frameworks are commonly used in the study of multicultural education: assimilation and pluralism. According to Rong and Preissle (2009), research on immigration and education was once dominated by the assimilation model, which advocated the elimination of ethnic identity and the reconstruction of an "all American and English-speaking only" immigrant identity. The assimilation paradigm, sometimes called a monocultural perspective, espouses tolerance and acceptance of differences in an effort to uphold the existing social structure and power relations – it shares an image or model of "American culture" in the United States (Cushner, McClelland, & Safford, 2006; Grant, Elsbree, & Fondrie, 2004).

Instead of the traditional view of immigrants and ethnic minorities, the consideration of pluralistic perspectives in education and society is paramount, particularly in teacher education and student's schooling. The pluralism paradigm is built upon the philosophical ideas of freedom, justice, equality, equity, and human dignity (Grant, et al., 2004). Under pluralism, ethnic groups can maintain their distinctive cultural identities, which imply recognition of ethnicity as a legitimate way of grouping in the society. The pluralism model accounts for the variety of objectives, processes, or outcomes that are found among different immigrant communities (Rong & Preissle, 2009).

Through teacher preparation, teachers develop knowledge and understand student diversity, the instructional context in education, and the influence of educational policy in order to improve students' learning experiences and the schooling process. Furthermore, education with a multicultural perspective requires education professionals and teachers to assist students in developing a clear understanding and appreciation of the diverse ethnic and racial groups from pluralistic perspectives (Chepyator-Thomson, 2001). Although there are likely many factors in the school setting that account for differential achievement levels of culturally diverse students, teachers' knowledge and skills that respect pluralistic perspectives are integral to student learning.

Theoretical Perspectives on Teachers' Knowledge and Skills in Multicultural Education

In education, questioning what qualities, understanding, categories and types of knowledge that competent teachers should have is paramount. According to Shulman (1987) teachers need to understand 'what is to be learned' and 'how it is to be taught,' and he categorizes knowledge into the following types: (1) content knowledge; (2) general pedagogical knowledge; (3) curriculum knowledge; (4) pedagogical content knowledge; (5) knowledge of learners and their characteristics; and (6) knowledge of educational contexts (p. 8). As the goal of multicultural education is to provide equal opportunities for all students by directing educational experiences that help them become knowledgeable and respectful of others, teachers' knowledge and skills becomes extremely important in research examination. Educators who seek a comprehensive understanding of cultural diversity and expertise in multicultural education should direct attention to both cognitive and affective factors (Manning & Baruth, 2009), pointing to teachers' knowledge and skills in multicultural education as embracing cultural competency, cultural sensitivity, culturally responsive pedagogy, and racial identity. This section focuses on theoretical perspectives and emergent themes from the literature

Cultural Competency and Cultural Sensitivity

Cultural competency is defined as the ability to understand and relate to the uniqueness of each individual in light of diverse cultures (Stuart, 2004). A cultural competent person has the ability to interpret experiences and patterns such as intentional communications (language, signs, gestures), some unconscious cues (such as body language), and understands customs different from one's own (Bennett, 2007; Reich & Reich, 2006). Thus, to become a culturally competent person, one must have sufficient knowledge, practical experience, and appreciation for cultural differences relative to his/her own personal identities, values and beliefs.

According to McAllister and Irvine (2000), less attention is given to the process through which teachers develop cultural competency, and in particular, the various factors that contribute to the development of teachers' cultural competency in in-service programs. The findings from their research reveal three different process theories or models that promote development of cultural competency. Bennett's Developmental Model of Intercultural Sensitivity (DMIS) offers an orderly, coherent, and empirically

Table 1. ***Development Model of Intercultural Sensitivity (Bennett, 2007).***

Levels	Stages	Descriptions
1	Denial	Does not recognize cultural differences
2	Defense	Recognizes some differences, but sees them as negative
3	Minimization	Unaware of projection of own cultural values; sees own values as superior
4	Acceptance:	Shifts perspectives to understand that the same "ordinary" behavior can have different meanings in different cultures
5	Adaptation	Can evaluate other's behavior from their frame of reference and can adapt behavior to fit the norms of a different culture
6	Integration	Can shift frame of reference and also deal with resulting identity issues

validated taxonomy of intercultural competencies that provide a framework to understand individual development and awareness from highly ethnocentric to highly ethnorelative (Bennett, 2007).

In Burdett-Williamson's (1996) study, significant positive relationships between intercultural sensitivity and independent variables related to international/cross-cultural experiences were present, pointing to the need to have pre-service teachers enroll in several courses with international/cross-cultural concepts and to complete their field experiences in diverse settings. Domangue and Carson (2008) investigated how the service-learning program shapes the pre-service physical education teacher's cultural competency and the findings revealed that service-learning participants should identify consistent engagement, exposure to another culture, and an engaged instructor as key contributors to cultural competency. It may be concluded that it is important for novice teachers to engage in meaningful teaching experiences in diverse environments in order to improve their overall understanding and eliminate any stereotypic conceptions of their role as a teacher of learners from diverse backgrounds (Stroot & Whipple, 2003).

Culturally Responsive Pedagogy

Culturally responsive pedagogy-also known as culturally relevant pedagogy-is a way of teaching that empowers students intellectually, socially, emotionally, and politically through the use of cultural references that impart knowledge, skills, and attitudes (Ladson-Billings, 2001). Gay (2002) considers culturally responsive teaching as embodying cultural knowledge, prior experiences, and explains performance styles of diverse students as promoting a more appropriate and effective learning, using a pedagogy that capitalizes on students' strengths. Indeed "culturally responsive teaching is an approach to instruction that responds to the socio-cultural context and seeks to integrate the cultural content of the learner in shaping an effective learning environment" (Ooka Pang, 2005, p. 336). Hence culturally responsive educators teach about people's differences as responsive to the cultural identity of learners, and the teachers tend to have a moral responsibility to be culturally responsive or to design curricular programs that cater to the educational needs of learners from diverse backgrounds.

According to Gay (2002), culturally responsive teaching consists of several characteristics: (1) it acknowledges the legitimacy of the cultural heritages of different ethnic groups, both as legacies that affect students' dispositions, attitudes and approaches to learning, and as a worthy content to be taught in the formal curriculum; (2) it builds bridges of meaningfulness between home and school experiences, as well as between academic abstractions and lived socio-cultural realities; (3) it uses a wide variety of instructional strategies that are connected to different learning styles; (4) it teaches students to know and praise their own and each others' cultural heritages; and (5) it incorporates multicultural information, resources, and materials in all the subjects and skills routinely taught in schools .

Landson Billings's (2001) research on teacher education programs and pre-service teachers provides the best ways to support teaching for diversity. According to her, instructional practices culturally responsive to the needs of student learners are paramount. Calling her theoretical framework "culturally relevant pedagogy" (p. 144), the propositions that successful teachers possess emphasized (1) students' academic achievement, (2) students' cultural competence, and (3) students' sense of sociopolitical consciousness. Indications of success center on views that students are capable of learning, that achievement is contextualized within the classrooms, and that teachers know content and how to teach the content to students and how to support the development of students' critical consciousness in curriculum, and finally that teachers encourage an academic achievement that is multidimensional. A second set comprises indicators of cultural competence that help determine how teachers can improve their teaching practices. These include teachers' understanding of culture and the role of culture in education; teachers taking responsibility for learning about students' culture and community; the teachers' use of their students' culture as a foundation for learning; and teachers' support of the flexible use of students' local and global culture. The last indicators are those of sociopolitical consciousness, as associated with issues of social justice (Ladson-Billings, 2001). These include teachers' knowledge of the larger sociopolitical context of the school, community, nation, and world; teachers' investment in the public good; teachers' development of academic experiences that connect students' perspectives to the larger social context; and teachers' understanding that their students' success will lead to an improved quality of life.

Racial Identity

Race is sometimes socially defined on the basis of physical criteria (i.e., skin color, facial features), while an ethnicity is socially defined on the basis of cultural criteria (i.e., customs, shared history, shared language) (Cushner, et al., 2006). Helms (1992, 1993) stated that all people undergo a developmental process of racial identity. This theory involves "how you perceive yourself as a racial being as well as how you perceive others racially" (Helms, 1992, p. 23). For example, although all white persons know that they are white, their psychological orientation to being white differs. For some people "being white" is just being "normal" without any thought about the racial significance of that position. People who experience racial identity in this way miss the reality of a society dominated by whiteness in which people of color are denied access to "normalcy." By contrast, other people may recognize the privileges that whiteness affords them while also trying to work in alliance with people of color to challenge racist policies and practices (Lawrence, 1998). Helms (1993) theorized that white persons undergo six stages in their white identity development and these include: (1) contact, (2) disintegration, (3) reintegration, (4) pseudoindependent, (5) immersion/emersion, and (6) autonomy.

The next section discusses various perspectives of physical education teachers' knowledge and skills in multicultural education. These perspectives, derived from this reviewing of research literature, provide valuable insights into understanding teaching in multicultural settings in physical education.

Multicultural Education in the Context of Teaching in Physical Education

Educational agencies in physical education use policy statements to encourage increased involvement in multicultural education. The National Association for Sport and Physical Education (NASPE,

2003a) addressed concepts of multicultural education through standards-based reform strategies that emphasize the importance of respect for others. In context of teaching, Standard 5 puts emphasis on the development of a "responsible personal and social behavior that respects self and others in physical activity settings," advocating for students to exhibit this behavior in school physical education. The NASPE (2003b) established the National Standards for Beginning Physical Education Teachers, which advocates standards-based teacher education and teaching in the context of diversity. Standard 3 centers on diverse learners, focusing on understanding how individuals differ in their approaches to learning and on the creation of appropriate instruction. The core concept of this standard is based on a beginning teacher's ability to understand, appreciate, and address individual differences in learning concepts such as physical disability, and culturally diverse backgrounds. This standard especially seeks to diversify instructional approaches through the design of learning environments that meet the learners' academic and social development needs.

Overall, successful physical education teachers in the culturally diverse school setting (e.g., urban schools) tend to maintain high expectations for student accomplishment, provide the best possible learning environments, and implement activities that aid increased student involvement (Ennis, et al., 1997; Henninger, 2007; McCaughtry, Barnard, Martin, Shen, & Kulinna, 2006). The review of literature on physical education teachers' knowledge and skills in multicultural education are organized into two categories: research relevant to pre-service teachers and in-service teachers.

Physical Education Teachers' Knowledge and Skills in Teaching Culturally Diverse Students

Pre-service teachers. Several scholars (Culp, Chepyator-Thomson & Hsu, 2009; Meaney, Bohler, Kopf, Hernandez, & Scott, 2008; Sparks & Verner, 1995; Stanley, 1996, 1997) have considered pre-service teachers' knowledge and attitudes about multicultural education to be important areas of research. Spark and Verner (1995) examined pre-service teachers' perceptions of, and attitudes toward, multicultural education prior to involvement in four instructional activities. It was discovered that perceptions of, and attitudes toward multicultural education among pre-service teachers prior to field practice could be enhanced with discipline-specific knowledge and integrated into classroom group participation. Stanley (1996, 1997) developed the Pluralism and Diversity Attitude Assessment instrument that assessed attitudes toward cultural diversity and pluralism among pre-service physical educators, revealing teachers to respect and value cultural diversity but did not seem to value actions or wish to implement culturally sensitive pedagogical practices.

Meaney, et al.'s research (2008) revealed that service-learning programs to impact pre-service educators' development of cultural competence. The service-learning component provided pre-service educators with opportunities to teach physical education to students from diverse backgrounds. Daily interaction with the children broadened pre-service teachers' understanding of under-served children, changed their preconceived stereotypes, improved their language and communication skills, and impacted their future teaching expectations Domangue and Carson (2008) investigated how a service-learning program shapes pre-service physical education teacher's cultural competency. The pre-service teachers identified key factors that contribute to cultural competency within the service-learning program, which include consistent engagement, exposure to another culture, and an engaged instructor. Culp, et al. (2009) examined a multicultural service learning practicum in a physical education teacher education program, where the pre-service teachers used reflective journals to document their experiences. Evident in their journal comments were pre-service teachers' experiences that indicated value of unique situations that exposed them to diversity, revealing the practicum experience to promote learning in cognitive and affective domains of physical education. Research on physical education teacher education suggests service-learning programs are valuable in enhancing pre-service educators' cultural competence for teaching, and show that teacher educators should work toward not only sensitizing prospective teachers to culturally diverse students, but also to need to guide and encourage these future educators in adopting and implementing educational programs that are responsive to cultural diversity (Stanley, 1997).

In conclusion, research on pre-service teacher education reveal that students may personally respect and value cultural diversity but may not be ready to take substantive actions or pedagogical practices to change class environments to promote the inclusion of all students. Researchers generally agree, however, that practicum or field-based experiences are helpful in changing pre-service physical education teachers' perceptions of their multicultural knowledge and attitude, and their cultural competency to adapt their teaching methods to meet the needs of all students.

In-service teachers. In the early 1990s, researchers (Sparks,et al., 1996; Sparks & Wayman, 1993) investigated physical education teachers' knowledge and skills to understand diversity issues in U. S. education. In their research study, urban teachers and rural teachers seem to have different understandings of ethnic diversity. While teachers in urban areas appeared to have a better understanding of the importance of designing a curriculum that included characteristics of ethnic diversity, teachers in rural areas had a greater appreciation of the customs and traditions of differing cultures, and seemed to appreciate the importance of providing curricular opportunities that promoted interaction between students of different ethnic groups. Furthermore, in-service physical education teachers had high knowledge levels and positive attitudes toward multicultural education; however they did not have specific plans for the development and promotion of multiculturalism within the physical education program (Sparks, et al., 1996).

Another study examined physical education teachers' attitudes and knowledge levels about working with Mexican American students (Tabb & Joonkoo, 2005). The results showed that participants were found to have positive attitudes and moderately high knowledge levels about Mexican American culture. Furthermore, functional Spanish language skills appeared to be a critical first step to enable educators to work more effectively with Mexican American students. A recent study of Harrison, Carson, and Burden (2010) found teachers of color to be more culturally competent than White teachers in an assessment of their physical education teachers' cultural competency. Teachers of color scored

higher in both multicultural teaching knowledge and multicultural teaching skills than their white counterparts. The results also support the findings from previous research studies (Sparks & Wayman, 1993; Sparks, et al., 1996) that the White teachers in city school settings scored significantly higher in multicultural teaching knowledge than those from rural schools (Harrison, et al., 2010).

In Chepyator-Thomson, et al.'s (2000) study of in-service physical education teachers, the responses on the question of definition of multicultural education revealed a continuum, from teachers who were non-committal to teachers who valued inclusive instructional practices in the physical education program. As illustrated in Figure 1, the result was arranged into four categories: (a) non-committal and non-directional orientation; (b) acquisition of conceptual knowledge; (c) awareness of cultural diversity; and (d) inclusive education.

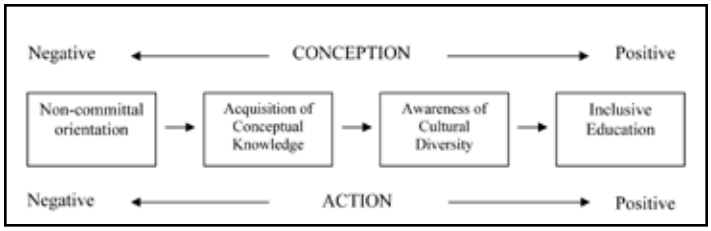

Figure 1. A *continuum of teachers' understanding of multicultural education*. (Chepyator-Thomson et al., 2000, p. 561)

Additionally, the study indicated that in-service teachers: (a) had a lack of knowledge and experience about multicultural education, and (b) expressed the need for multicultural education training and for teacher preparation programs that address issues of diversity, and promote dissemination of multicultural education information in public schools (Chepyator-Thomson, et al., 2000).

Hastie, Martin, and Buchanan (2006) studied White teachers' understanding of praxis connected to an authentic middle physical education program, and it was discovered that the curricular content covered was responsive to the African-American vernacular dance tree. Five specific themes emerged: teacher apprehension; concerns about teacher legitimacy; resolution of apprehension and concerns; the unique nature of the content; and continual ethical uneasiness. The teachers expanded their understanding of praxis beyond thinking, acting, and reflecting to consider the political and social aspects that impact curriculum, pedagogy and student learning.

McCauhtry, Sofo, Rovegno, and Curtner-Smith (2006) reported that teachers have unique challenges that significantly shaped their thinking about students and their careers, along with strategies that they used to overcome or manage these challenges. These challenges included: (a) insufficient instructional resources, (b) implementation of culturally relevant pedagogy, (c) community violence, (d) integration of more games in curricula, and (e) teaching in a culture of basketball. Implications centered on development of an informed and realistic vision of urban physical education, particularly in teacher preparation and professional development.

In conclusion, the research found that in-service physical education teachers had high knowledge levels and positive attitudes toward multicultural education; however, they did not have specific plans for the development and promotion of multiculturalism within the physical education program. Furthermore, the participants in these studies were found to be limited to White teachers, although Harrison, et al. (2010) recently found that teachers of color tend to be more culturally competent with their knowledge and skills than White teachers. However, the literature cited here indicates what has been discovered about in-service physical education teachers' knowledge and skills in teaching culturally diverse students and provides baseline information for future research.

Although multicultural education is important in physical education, a limited number of studies have been published. For example, Chepyator-Thomson, et al. (2008) noted the low publication rates (1.39%) on issues related to multiethnic and diversity education in physical education, pointing to the dire need to have teachers prepared with sufficient and relevant knowledge and the experiences that promote appreciation and implementation of multiculturalism in school curriculum and pedagogy.

Multiculturalism in the Context of Curriculum in Physical Education

Curriculum guides instruction, leading to the production of long-term planned outcomes for student education. Many curricular decisions in today's education follow content standards at the national, state, and local levels. In physical education, various curricular models have been developed based on the national standards but differ on points of emphasis and desires for achievement. Chepyator-Thomson (2001) suggested five different paradigms in the physical education curriculum: a fitness perspective, a developmental physical education perspective, a movement education perspective, a humanistic physical education perspective, and a culture-based perspective and based on these paradigms, several curriculum models have been developed. Each model espouses a primary goal for the national standards, allowing physical education teachers to select program objectives and determine the school curriculum accordingly. Of all the models, Hellison's (2003) Teaching Personal and Social Responsibility (TPSR) model best promotes multicultural perspectives in teaching in physical education, with one of its main objectives being helping students to understand and respect differences among people in physical activity settings. However, most curriculum models in K-12 physical education focus on teacher perspectives and the dominant cultural group, and without understanding students' perspectives it is unlikely teachers can design curricula that students will find meaningful and valuable (Strand, 1996). Furthermore, when the curriculum focuses predominantly on the experiences of one group, all students suffer negative consequences. This type of curriculum denies students the chance to experience and grow from knowledge, perspectives, and reference points of groups other than their own and to view their own group from another's point of view (Butt & Pahnos, 1995).

The most important goal of multicultural education is to develop a curriculum that permits students to appreciate and participate in a variety of movements from global-local perspectives, thus allowing for opportunities for people to co-exist in harmony even when they come from different ethnic, social and educational background (Chepyator-Thomson et al., 2008). To effectively conceptualize and implement a multicultural education curriculum,

it is necessary not only to define the concept in general terms but to describe it programmatically (Banks, 2002). In physical education, several research studies have contributed to enhancing a curriculum for teaching culturally diverse students. Published articles cover teaching those students through integrating a traditional/cultural dance curriculum. For example, an ethnic dance project helped children to celebrate diversity among people once they understood the value of differences and commonalities (McGreevy-Nichols & Scheff, 2000). Prevots's (1991) study on "Dance and Society" promoted creative expression from the world perspective, examining traditional forms and emerging artists in Western and non-Western societies, their relationships, and mutual influences, enhancing the growing interest in an inclusive global and multicultural curriculum.

Summary

The global trends on human migrations point to a growing diverse student population in schools in the United States. Scholars and in-service teachers try to respond to this student diversity through making changes in curriculum and instruction. Through teacher education programs teachers develop an understanding of students' backgrounds, create relevant instructional contexts, and promote enactment of public policy initiatives that improve students' learning experience and their process of schooling. Multicultural education coursework and field experiences in teacher education programs are thought to be important avenues for developing positive attitudes toward cultural diversity and for developing practices that promote cultural pluralism. A firm multicultural education program for pre-service and in-service teachers can be created based on research studies discussed. Previous research studies focused on a variety of issues of multicultural education in physical education. Despite the limited number of studies and the wide range of examination, the results of these studies reveal that physical education teachers have varying degrees of knowledge and understanding of multicultural education. Furthermore, these findings underscore the important role of a pre-service teacher education program that values multiculturalism in teacher education. Culturally responsive pedagogy in physical education ensures that novice teachers are trained to reflect on their personal assumptions, stereotypical beliefs, and behaviors toward learners from various diverse groups (Hodge, 2003; Sparks, 1994), making them cognizant of differences that exist between urban, rural, and suburban schools, and enlightening them about cultural and ethnic diversities of students such as learning styles, preparedness, and readiness of students to learn (Kantor & Brenzel, 1992). Based on the literature review, scarce attention has been given to the process of development of physical education teachers' diversity, including areas of cultural competency, cultural sensitivity, culturally responsive pedagogy, and racial identity. Preparing in-service teachers and pre-service teachers for diversity in schools requires a firm consideration of curriculum and instruction that is inclusive of multicultural education.

References

Allard, A. C., & Santoro, N. (2008). Experienced teachers' perspectives on cultural and social class diversity: Which differences matter? *Equity & Excellence in Education, 41*(2), 200-214.

American Association of College Teachers. (1994). *Minority teacher recruitment and retention: A public policy issue*. Washington, DC: Author.

Aud, S., Hussar, W., Planty, M., Snyder, T., Bianco, K., Fox, M., et al. (2010). *The Condition of Education 2010*. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.

Banks, J. A. (2002). *An introduction to multicultural education* (3rd ed.). Boston: Allyn and Bacon.

Bennett, C. I. (2007). *Comprehensive multicultural education : theory and practice* (6th ed.). Boston, MA: Pearson Allyn and Bacon.

Burden, J., Hodge, S., & Harrison Jr, L. (2004). From colorblindness to intercultural sensitivity: Infusing diversity training in pete programs. *Quest, 56*(2), 17.

Burdette-Williamson, P. (1996). The intercultural sensitivity of teachers in vocational family and consumer sciences and agricultural education. *Journal of Vocational Education Research, 21*, 65-84.

Butt, K. L., & Pahnos, M. L. (1995). Why we need a multicultural focus in our schools. *Journal of Physical Education, Recreation and Dance, 66*, 48-53.

Chang, I. S. (2008). Exploring and developing model of teacher curriculum for multicultural education. *The Journal of Elementary Education, 21*(2), 281-305.

Chepyator-Thomson, J. R. (2001). Curriculum and instruction in primary school physical education: A critique and visionary perspective for reform in teacher education. In C. A. Grant & M. L. Gomez (Eds), *Campus and classroom: Making schooling multicultural* (2nd ed. pp. 259-280). Upper Saddle River, NJ: Prentice Hall.

Chepyator-Thomson, J. R., Kim, S., Xu, F., Schmidlein, R., Na, J. Choi, W., & Yeo, C. (2008). Multiethnic diversity research in K-12 U.S. physical education: A synthesis of literature in kinesiology-based journals (1995-2005). *ICHPER•SD Journal of Research, 3*, 33-39.

Chepyator-Thomson, J. R., You, J., & Russell, J. (2000). In-service Physical Education Teachers: Background and Understanding of Multicultural Education. *Journal of In-service Education, 26*(3), 557-568.

Culp, B. O., Chepyator-Thomson, J. R., & Hsu, S. H. (2009). Pre-service teachers' experiential perspectives based on a multicultural learning service practicum. *The Physical Educator, 66*, 23-36.

Cushner, K., McClelland, A., & Safford, P. L. (2006). *Human diversity in education : an integrative approach* (5th ed.). Boston: McGraw-Hill.

DeSensi, J. T. (1995). Understanding multiculturalism and valuing diversity: A theoretical perspective. *Quest, 47*, 34-43.

Domangue, E., & Carson, R. L. (2008). Preparing culturally competent teachers: Service-learning and physical education teacher education. *Journal of Teaching in Physical Education, 27*(3), 347-367.

Ennis, C. D., Cothran, D. J., Davison, K. S., Loftus, S. J., Owens, L., Swanson, L., et al. (1997). Implementing curriculum within a context of fear and engagement. *Journal of Teaching in Physical Education, 17*, 52-71.

Fleming, D., Mitchell, M. F., & Gorecki, J. (1999). Students change and so do good programs: addressing the interests of multicultural secondary students. *Journal of Physical Education, Recreation and Dance, 70*(2), 79-83.

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal of Teacher Education, 53*(2), 106-116.

Grant, A. C., Elsbree, R. A., & Fondrie, S. (2004). A decade of research on the changing terrain of multicultural education research. In J. A. Banks, & C. A. McGee-Banks, Handbook of research on multicultural education (pp. 184-207). San Francisco: Jossey-Bass.

Harrison Jr, L., Carson, R. L., & Burden Jr, J. (2010). Physical education teachers' cultural competency. *Journal of Teaching in Physical Education, 29*(2), 184-198.

Hastie, P. A., Martin, E., & Buchanan, A. M. (2006). Stepping out of the norm: an examination of praxis for a culturally-relevant pedagogy for African-American children. *Journal of Curriculum Studies, 38*(3), 293-306.

Hellison, D. (2003). *Teaching responsibility through physical activity:* Human Kinetics Publishers.

Helms, J. E. (1992). *A race is a nice thing to have: A guide to being a white person or understanding the white persons in your life*. Topeka, KS: Content Communications.

Helms, J. E. (1993). *Black and white racial identity : theory, research, and practice*. Westport, Conn.: Praeger.

Henninger, M. (2007). Lifers and troupers: Urban physical education teachers who stay. *Journal of Teaching in Physical Education, 26*, 125-144.

Hodge, S. R. (2003). From ethnocentricism to ethnorelativism: Advocacy for implementing diversity training and multiculturalism in PETE programs. *Chronicle of Physical Education in Higher Education, 14*(3), 15-16.

Kantor, H. & Brenzel, B. (1992). Urban education and the "truly disadvantaged": The historical roots of the contemporary crisis, 1945-1990. *Teachers College Record, 94*, 278-314.

Ladson-Billings, G. (2001). *Crossing over to Canaan: The journey of new teachers in diverse classrooms*. San Francisco: Jossey-Bass.

Lawrence, S. M. (1998). Research, writing, and racial identity: cross-disciplinary connections for multicultural education. *The Teacher Educator, 34*(1), 41-53.

Manning, M. L., & Baruth, L. G. (2009). *Multicultural education of children and adolescents* (5th ed.). Boston: Pearson.

Matus, D. (1999). An innovative strategy supports student teachers in urban secondary schools. *The Clearing House, 73*, 37-42.

McAllister, G., & Irvine, J. J. (2000). Cross cultural competency and multicultural teacher education. *Review of Educational Research, 70*, 3.

McCaughtry, N., Sofo, S., Rovegno, I., & Curtner-Smith, M. (2004). Learning to teach sport education: Misunderstandings, pedagogical difficulties and resistance. *European Physical Education Review, 10*, 135-156.

McCaughtry, N. Barnard, S., Martin, J., Shen, B., & Kulinna, P. H. (2006). Teacher's perspectives on the challenges of teaching physical education in urban schools. The student emotional filter. *Research Quarterly for Exercise and Sport, 77*, 486-497.

McGreevy-Nichols, S., & Scheff, H. (2000). Teaching cultural diversity through dance. *Journal of Physical Education, Recreation and Dance, 71*(6), 41-43.

Meaney, K. S., Bohler, H. R., Kopf, K., Hernandez, L., & Scott, L. S. (2008). Service-learning and pre-service educators' cultural competence for teaching: An exploratory study. *Journal of Experiential Education, 31*(2), 189-208.

National Association for Sport and Physical Education. (2003a). *Moving into the future : National standards for physical education* (2nd ed.). Reston, VA: Author.

National Association for Sport and Physical Education. (2003b). *National Standards for Beginning Physical Education Teachers* (2nd Edition ed.). Oxon Hill, MD: Author.

Nelson-Barber, S. & Mitchell, J. (1992). Reconstructing for diversity: Five regional portraits. In M. E. Dilworth (Ed.), *Diversity in teacher education: New expectations* (pp. 229-262). San Franciso, CA: Josey-Bass Publishers.

Ooka Pang, V. (2005). *Multicultural education: A caring-centered approach* (2nd ed.). Boston: McGraw-Hill.

Prevots, N. (1991). The role of dance in multicultural education. *Journal of Physical Education, Recreation and Dance, 62*, 34-35.

Reich, S., & Reich, J. (2006). Cultural competence in interdisciplinary collaborations: A method for respecting diversity in research partnerships. *American journal of community psychology, 38*, 51-62.

Rong, X. L., & Preissle, J. (2009). *Educating immigrant students in the 21st century : what educators need to know* (2nd ed.). Thousand Oaks, Calif.: Corwin Press.

Sachs, J. M., & Poole, M. E. (1989). Multicultural education policies in Australia and Britain: Social transformation or status quo? *Education and Society, 71*, 9-19.

Santrock, J. W. (2001). *Educational psychology*. New York: McGraw Hill.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1-22.

Sparks, W. G. (1994). Culturally responsive pedagogy: a framework for addressing multicultural issues. *Journal of Physical Education, Recreation and Dance, 65*, 33-36.

Sparks, W. G., Butt, L. K., & Pahnos, M. (1996). Multicultural education in physical education: A study of knowledges, attitudes and experiences. *The Physical Educator, 53*, 73-86.

Sparks, W., & Verner, M. E. (1995). Intervention strategies in multicultural education: A comparison of pre-service models. *Physical Educator, 52*(4), 170-186.

Sparks, W., & Wayman, L. (1993). Multicultural understanding in physical education: A comparison of urban and rural perspectives. *Physical Educator, 50*, 58-58.

Stanley, L. S. (1996). The development and validation of an instrument to assess attitudes toward cultural diversity and pluralism among preservice physical educators. *Educational and Psychological Measurement, 56*, 891-897.

Stanley, L. S. (1997). Preservice physical educators' attitudes toward cultural pluralism: A preliminary analysis. *Journal of Teaching in Physical Education, 16*(2), 241.

Strand, B. N. (1996). *Fitness education : ideas and applications for secondary schools*. Dubuque: Kendall/Hunt.

Stroot, S.A., & Whipple, C.E. (2003). Organizational socialization: Factors affecting beginning teachers. In S.J. Silverman & C.D. Ennis (Eds.), *Student learning in physical education: Applying research to enhance instruction* (2nd ed.; pp. 311-328). Champaign, IL: Human Kinetics.

Stuart, R. B. (2004). Twelve practical suggestions for achieving multicultural competence. *Professional Psychology Research and Practice, 35*, 3-9.

Suarez-Orozco, M. M. (2005). Rethinking education in the global era. *Phi Delta Kappan, 87*(3), 209.

Tabb, J. K., & Joonkoo, Y. (2005). Physical educators' attitudes and knowledge about working with mexican americans. *ICHPER•SD Journal of Research, 41*(3), 16-21. ■

The First Step: Assessing the Coaching Philosophies of Pre-service Coaches

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Abstract

Coaches are influential in creating positive and achievement-oriented sport environments and the development of a sound philosophy is the key to successful coaching (Martens, 2004). Yet, few coaches spend significant time early in their careers developing and modifying their philosophical beliefs (Wilcox & Trudel, 1998). While coaching educators have consistently recognized the importance of a well-honed coaching philosophy, little research has examined the beliefs of pre-service coaches. Therefore, this study examined written coaching philosophy statements of 35 pre-service coaches (PSCs) prior to enrollment in an intensive 15-week coaching education course. An inductive content analysis revealed several emergent dimensions and priorities: Coaching Behavior, Defining Success, Development, Expectations, Fun, Life Lessons Learned Through Sport, and Relationships. It was clear that these young coaches have strong expectations of the sport experience. What was less clear was their role in creating positive sport experiences, which highlights the importance of coaching education in transforming philosophy into action.

Key Words: coach education, novice coaches, coaching psychology

Introduction

Think of your favorite coach. What makes them great? Chances are it is their beliefs, values, and approach to their athletes and the sport that make these coaches stand out from the rest. Differences in belief systems, values, and approaches to performance and participation in sport distinguish successful coaches at all levels (i.e., youth, school, club, collegiate, national). At the heart of these differences are unique philosophies that guide their behavior and decisions. Martens (2004) indicated that a sound philosophy is the key to successful coaching and to the provision of positive sport experiences. He proposed that the three central elements of a coaching philosophy are the relative roles of winning, development, and fun. Similarly, Vealey (2005) operationalized these three elements as optimal performance, optimal development, and optimal experience, where Burton and Raedeke (2008, p.6) identified "personal excellence-the foundation for success" as a sound working philosophy. Sport psychology professionals like Martens, Vealey, Burton, and Raedeke have been at the forefront of developing and evaluating coaching education. While each of these individuals has identified the critical role of coaching philosophy, little is known about how coaching philosophies are developed.

Recognizing that coaches are the providers and interpreters of sport experience, coaches' philosophical beliefs are central to the climate they create. Building a theoretically driven and research-based coaching philosophy that can drive professional practice could be a significant factor in improving the coaching experience, and in turn, the performance and experience of athletes. The process of developing a coaching philosophy is complex and continually evolving. Young coaches need to reflect on and integrate their experience as a coach and athlete, and their knowledge of the sport and training demands of the sport, with sound research on coaching behaviors (Smoll & Smith, 2002), developmental considerations (see Weiss, 2004), participant motives (Weiss & Williams, 2004), and motivational theory (Conroy, Kaye, & Coatsworth, 2006; Fredricks & Eccles, 2004), to name a few. Recognizing this complexity within coaching philosophy, it is not surprising that few investigators have undertaken this effort.

Central to the development of a coaching philosophy is the approach to achievement. Both Martens' (2004) and Vealey's (2005) frameworks have employed constructs from achievement goal theory and subsequent research on motivational climate (See Ntoumanis & Biddle, 1999). Understanding how individuals define success and failure is at the heart of these theories. Motivational orientations are proposed to be dispositional and therefore can be affected by the environment and individuals who frame the environment. Coaches clearly craft the environment in sport settings and thus influence individuals' performance and experience. It is the motivational climate that has the potential to influence individual perceptions of their ability and subsequent motivation (Balaguer, Duda, & Crespo, 1999). While motivational climate has been extensively examined, the link between motivational climate and coaching philosophy remains unexplored.

The link between theories of achievement motivation and philosophy development appears to be contained in the key components identified by Martens (2004) as well as Burton and Raedeke (2008). These include the major objectives and the principles or beliefs that help coaches achieve those objectives (Martens, 2004). One of the few investigations examining coaching philosophy utilized interviews with youth baseball and softball coaches (McCallister, Blinde, & Weiss, 2000). The authors found that coaches' philosophies tend to focus on two key elements: learning skills and having fun. They also found that coaches did not identify key issues such as the roles of winning and competition, and the value of participation as part of their philosophies, until prompted. Many of these coaches, while able to articulate their philosophies, had difficulty describing how they teach those values and life skills within their philosophy on a day-to-day basis. They concluded, "The extent to which coaches can articulate their philosophies and the degree to which their behavior parallels those philosophies are important in determining the nature of the participant's experience" (McAllister, et al., 2000, p. 36). Furthermore, results indicate that these coaches regularly experienced inconsistencies between their beliefs and actions. Common inconsistencies occurred in dealings with inappropriate behavior, communication, playing time, and the emphasis on winning.

In reviewing the limited research relative to coaching

philosophy, an early investigation of over 500 male high school coaches of girls' and boys' basketball teams, examined gender differences in coaching philosophies (Pratt & Eitzen, 1989). While the examination of gender differences in coaching philosophies was the primary purpose of this study, their findings reinforced perceptions that principles and beliefs are altered or shaped by experience and social context. The important role of experience exposes a gap in the literature relating to novice coaches. If experience is essential to the formulation of a coaching philosophy, where and how do young coaches begin this process?

Aside from the aforementioned research, most of the coaching literature does not explicitly explore coaching philosophy. Consistent with Gilbert and Trudel's (2004a) meta-analysis of coaching research, the primary focus has been on coaching behaviors of experienced coaches and their effects on athletes (Smith & Smoll, 1997). Additionally, the development of knowledge and expertise (Abraham & Collins, 1998), mentoring of young coaches (Bloom, Durand-Bush, Schinke, & Salmela, 1998), and experience and reflection in coaching (Gilbert & Trudel, 2000; Gilbert & Trudel, 2005) were significant topics in the research literature. While coaching philosophy is not explicitly identified, the role of philosophy is implicit within many of these constructs. Issues such as coach behavior, knowledge, role framing, and mentoring, influence and are influenced by a coach's philosophical beliefs.

Philosophy is often alluded to in discussions of coaches' characteristics, role framing and behavior. For example, by investigating six case studies, Gilbert and Trudel (2004b) identified key components of a coach's personal approach to coaching, including discipline, fun, personal and athletic growth and development, positive team environment, winning, equity, and safety. These categories were described as *role frame components* and can arguably be described as priorities reflecting philosophical beliefs that impact daily action.

Similarly, Smoll and Smith's (1997) and Smith and Smoll's (2002) research examining Coach Effectiveness Training (CET) has identified principles that could be considered philosophical in nature. Specifically they argued for a positive approach to coaching and coaching education that takes into account a healthy attitude about winning and prioritizes development. Their research has demonstrated that coaches who create positive learning environments through sound instruction and feedback produce positive experiences for athletes.

Although a focus on coaching education programs has begun to impact the preparation of coaches (Gilbert & Trudel, 2005), very little research has focused on the next generation of coaches. Less than 6.1 percent of the coaching research includes prospective coaches as participants (Gilbert & Trudel, 2004a). There are no studies in the sport psychology or coaching literature that explore coaching philosophy in pre-service coaches (PSCs). However, research with veteran coaches shows that few coaches spend significant time early in their careers developing and modifying sound philosophical beliefs (Wilcox & Trudel, 1998). Since coaches learn most of their coaching knowledge through actual experience (Gilbert & Trudel, 2005), perhaps their philosophies develop over time through experience. It is imperative that applied sport psychology research examines philosophies of PSCs in order to gain a greater understanding of the extent and importance of their belief system prior to formal coach education as well as the practical application of those early beliefs. Only then, can coaching educators effectively prepare PSCs in the development of research-based coaching philosophies. Therefore, this study examined coaching philosophies of PSCs at the start of an intensive 15-week coaching education program. The purpose was to explore beliefs, values, and principles within philosophy statements of individuals prior to a coaching education program and significant coaching experience.

Method

Participants

Participants (N=35, males=19; females =16) enrolled in an intensive coaching education program at a mid-size Division I university in the U.S. wrote philosophy statements relative to their beliefs about coaching. On average, these individuals were just over 20 years of age (M=20.1) and 58% (n=20) of the participants identified themselves as student-athletes at the university. Almost half of the PSCs had no previous coaching experience (46%, n=16). The remaining 54% (n=19) had limited coaching experience averaging 2.5 seasons, predominantly as assistant coaches at the youth level. Further, less than 15% (n=5) were currently coaching or assistant coaching a team at either the youth or high school level. When asked about the extent to which they believed they would coach in the future, participants' responses ranged from 4 to 7, with a mean of 5.8, on a 7-point likert scale from unlikely to definitely. Two individuals enrolled in the program who had no plans to coach in the future completed the philosophy statements, but were removed from the analysis. Based on the limited coaching experience and the commitment of individuals to coach in the future, the remaining 35 participants were characterized as PSCs..

Procedure

Permission to conduct this study and approval for the use of human subjects was granted by the investigators' university Institutional Review Board. As members of an intensive 15-week coaching education program, these PSCs were asked to write a statement about their beliefs about coaching. Participants granted consent for the use of their statements and acknowledged that their statements would not be used as an evaluative component of the course. Prior to this in-class assignment the participants were asked to spend time reflecting on what they believed to be important about coaching and alerted that they would be writing these beliefs into a statement. Philosophy statements were written at the very beginning of the coaching education course prior to receiving materials, lectures or teaching points on coaching philosophy. PSCs were given the following directions: "In the space provided, please write a statement of your coaching philosophy. Philosophy is defined as the beliefs and principles that guide your actions. Please circle the level of sport you are referring to in your philosophy statement."

All 35 participants wrote a coaching philosophy statement. Statements ranged in length from half to one and a half pages, and all were completed within 30 to 50 minutes. After compiling the written philosophy statements, the statements were transcribed verbatim. At this point all the members of the research team read

each statement in order to develop a complete understanding of the data prior to content analysis. As recommended by Creswell (2003), the research team employed the pragmatic qualitative perspective of using multiple strategies and perspectives to understand the data. However, the primary approach utilized a thematic content analysis recommended by Miles and Huberman (1994). The research team's first step in the process of analysis was to agree on an operational definition of *coaching philosophy*. The research team mutually agreed to use Martens' (2004, p.6) definition ("beliefs or principles that help achieve your objectives") to discriminate between statements that fit or did not fit into the analysis. Each of the four members of the research team independently analyzed the data to identify quotes that clearly reflected the operational definition and which statements fell outside the definition. While the subsequent analysis only dealt with raw data associated with philosophy, other categories associated with coaching style, characteristics and level of coaching were also identified. Raw data units (N=177) (i.e., quotes representing a meaningful point or thought) associated with coaching philosophy were individually identified and consensually validated during group meetings with the four investigators. Quotes with similar meaning were merged into lower-order themes and labeled to reflect a common understanding. Lower-order themes were then analyzed for similarity and combined to reflect a common, more global understanding (i.e., higher-order theme). This process continued through to the development of final categories. At each step of this process the four person investigative team reached consensus in the merging and labeling of themes. It is important to note that while the data often coalesced cleanly from smaller lower-order themes to broader higher-order themes and general dimensions, there were cases where a particular lower-order theme carried through to a general dimension (e.g., contributors to success merged directly into the general dimension of Defining Success). In these cases, the same theme code (e.g., contributors) was carried through each level. Similarly, in one case (i.e., Development), the data was particularly complex and therefore it was necessary to include a middle-order theme between the lower-order theme and the higher-order theme.

Throughout the data analysis process, the research team aimed to retain the holistic view of the participants while maintaining the uniqueness of each individual participant. Trustworthiness of the data (Lincoln & Guba, 1985; Patton, 1990) was demonstrated by continually going back to the initial statements of the individuals, as well as through consensual validation of themes.

Results and Discussion

Initial results from the content analysis revealed seven general dimensions derived from a number of higher-order themes, lower-order themes, and raw data units. General dimensions included: Coaching Behavior, Defining Success, Development, Expectations, Fun, Life Lessons Learned Through Sport and Relationships. Patterns and themes emerging from each of these general dimensions and subsequent discussion are presented below.

Coaching Behavior

The general dimension of Coaching Behavior consisted of two higher-order themes: *coach creates climate* and *equitable treatment of athletes*, as well as a number of lower-order themes which merged directly into Coaching Behavior.

Coach creates climate. In this general dimension of Coaching Behavior, the higher-order theme of coach creates climate was highlighted by participants writing about the importance of 'creating a fun learning environment'. Specifically, one participant wrote "In order for your team to be successful you must combine enjoyment and fun with an atmosphere that makes players want to learn and encourage each other to learn" (PSC 9, line 256). This statement parallels findings from the work of McCallister, et al., (2000) where they identified the importance of coaching belief systems to include the philosophy of learning new skills while having fun. It is interesting to note how the participants in this investigation took ownership in creating a positive climate. This was one of the few times throughout the investigation where the participants clearly identified their role in implementing the belief systems.

Equitable treatment of athletes. PSCs also addressed the treatment of athletes and identified the next higher-order theme of equitable treatment of athletes by writing about the importance of fair and equitable treatment. One PSC highlighted this point by writing specifically about fair treatment in regards to playing time:

> I believe when coaching at the high school level every player deserves the chance to prove themselves and earn playing time. This does not mean everyone plays equally, but everyone is given a chance. Earned playing time would be based on performance, work ethic, and attitude (PSC 30, line 376).

While coach creates climate and equitable treatment of athletes were identified as the higher-order themes in the general dimension of Coaching Behavior, there were a number of lower-order themes that carried directly into Coaching Behavior. Examples of such lower-order themes included using an individualized approach to coaching, maximizing team potential, strategic playing time, supportive coaching behaviors, maximizing a learning experience, using effective communication and effective coaching behaviors. More specifically, participants wrote about the importance of flexibility and individualized approaches to coaching. For instance, one PSC simply stated, "You can't approach every situation the same [,]much the way you can't coach every kid the same way" (PSC 11, line 295).

PSCs also identified the importance of supportive coaching behaviors as a lower-order theme leading directly to the general dimension of Coaching Behavior. Supportive coaching behaviors included behaviors such as encouragement and positive reinforcement. An example of such beliefs is found in the following statement. "My philosophy to coaching is structured off positive reinforcement and enthusiasm" (PSC 8, line 251). Many of these themes refer to feedback and expectancies and relate to previous research on coaching behavior (Horn, 2008; Smith & Smoll, 1997). Further, sport psychology consultants and coaching educators can benefit from the knowledge of these belief statements in their work with teams, coaches, and individuals.

Along similar lines, participants identified how knowing their players can lead to maximizing team potential, and thus highlights another lower-order theme that lead directly to Coaching Behavior. "A coach should have an understanding of his/her players as

unique individuals and be able to combine these qualities together to create a fluid team" (PSC 20, line 173). However, while some participants highlighted the importance of equitable treatment and consistent playing time for individuals, others stated the importance of a coach effectively using strategic playing time. This lower-order theme of strategic playing time can be best understood in the following quote. "I will not hold back players when it comes to winning, the correct players need to be in the game" (PSC 30, line 369).

Strategic playing time, maximizing team potential, and an individualized approach to coaching are all related to the decision making of the coach. Gilbert and Trudel (2000) examined coaches' decision making as a link to the beliefs and behaviors exhibited by a coach and the statements by these PSCs support their work. Linking decision making to beliefs and behaviors is an important content area for coaching educators and sport psychology consultants. When working with coaches it is critical to help them process the reasons behind the decisions that they make.

It is not at all surprising to read about positive reinforcement and enthusiasm as part of the coaching philosophy of PSCs. Gilbert and Trudel (2004b) highlighted how coaching behavior and coaching belief systems is often a product shaped by experience. This finding supports this notion. The PSCs in this study were young adults who had very limited experience coaching (46% had no previous coaching experience). However, the majority of the participants were either current or former student-athletes and as a whole, they had extensive playing experience. Most current and former athletes highlighted the importance of positive reinforcement because they experienced supportive behavior and positive reinforcement and they attributed their success to it, or they did not experience these behaviors and therefore had negative attributes. Recognizing the importance of personal experience, it is not surprising that these PSCs highlighted this theme.

In summarizing the Coaching Behavior general dimension, participants made statements of belief in line with current literature. Of particular interest was the coach's role in creating a positive climate. This was one of the few times throughout the results where the PSCs took ownership for their role in contributing to a positive environment.

Defining Success

The second general dimension derived from the statements of coaching philosophy was Defining Success. This dimension consisted of four unique lower-order themes that merged directly to the general dimension of Defining Success. These unique lower-order themes included: contributors to success, success as a process over product, role of winning and losing, and discipline as the foundation of success.

Contributors to success. PSCs identified a number of contributors to success including effort, attitude, creativity, hard work and commitment. Specifically, participants were able to identify the influence of important characteristics in defining success. The theme of defining success based on attitude can be seen in the following statement:

> Attitude is just as important. Attitude reaches to many other aspects in sports. A positive strong attitude will guide a player and a coach to success. A good attitude will get you to practice early, keep you awake watching film, get that loose ball, keep you out of trouble, and will keep you focused and much more (PSC 6, line 78).

Success as process over product. In addition to defining contributors to success, participants were able to articulate the difference in process and product and thus emphasized the importance of process. This is exemplified in the following statement, "Wins keep everyone coming back but it is not all about product, it is all about process. Success can come at any point [,] not just after the final buzzer rings after play is complete" (PSC 2, line 13). The coaching literature relative to goal setting often identifies process over product. That is, the process of setting small, measurable, attainable goals throughout a season is a better indicator of success and improvement than the product (i.e., outcome) goals. Process goals are prominent in sport, whether in life skill development (Danish, Fazio, Nellen, & Owens, 2002; Gould, Collins, Lauer, & Chung, 2006) or in goal setting for performance (Wilson, Hardy, & Harwood, 2006). While these PSCs were able to identify the difference between process and product goals, coaching educators need to assist coaches in translating beliefs into behavior.

Discipline as the foundation of success. A number of the participants wrote extensively about discipline. Specifically, the participants were able to identify discipline as a building block for success. "It's my belief [that] discipline is the back bone of a successful team" (PSC 5, line 70). Once again, these PSCs wanted discipline on their teams but did not discuss how to create it or what discipline looks like.

Role of winning and losing. The final lower-order theme in Defining Success was the role of winning and losing. Individuals varied in their beliefs about winning and losing. For some, winning was the ultimate goal, while for others, athlete development was prioritized over winning. Differential views on the importance of winning can be seen in the following quotes. "If a coach cares about his/her players, he should thus always put their best interests first, even if this means putting winning second" (PSC18, line 150). Alternately, one PSC indicated, "I would put an emphasis on winning because I think it feels so great to achieve a win. I say that we wouldn't keep score if we weren't trying to win" (PSC13, line 95). While some of the participants had philosophical beliefs of "athletes first, winning second" (Martens, 2004, p.22), others emulated their current collegiate playing experience by focusing on the importance of winning. Coaching educators are often faced with the task of helping coaches to understand the role of winning and although these PSCs have limited experience thus far, they were able to articulate their beliefs about how they prioritized winning.

Development

The general dimension of Development was one of the richest dimensions in all the data. Because of the complexity and richness of this general dimension, the development of lower and higher-order themes was significantly more multifaceted than other dimensions. Almost all of the participants wrote about growth in some capacity as it became clear that development was a priority in their coaching. Results from content analysis revealed two higher-order themes, *athletic development* and *personal development*.

Athletic development. The higher-order theme of athletic

development consisted of a middle-order theme, as well as multiple lower-order themes. The middle-order theme of *development of an athletic mentality* as well as lower-order themes of supporting multiple sport experiences, skill development, goal setting process, development of a hard work ethic, and lessons of achievement merged to form the higher-order theme of athletic development. The middle-order theme of development of an athletic mentality reflected lower-order themes of development of a hard work ethic, goal setting process, developing confidence, and lessons of achievement. Participants described this athletic mentality in a number of ways, but in essence it could be characterized as the intangible skills athletes develop to help them succeed. For instance, one participant stated: "Encouraging the athletes to push themselves and allow them to see they are capable of much more than they ever imagined, helps build a stronger and more confident athlete" (PSC 5, line 68).

Both empirical and anecdotal evidence suggest that the development of an athletic mentality is a familiar concept in coaching (Vealey, 2005). As sport becomes inherently more specialized and competitive, the importance of mentally tough athletes is crucial. Coaches at all levels strive to recruit and maintain athletes who are confident and have this athletic mentality. What is interesting to note about the PSCs in this investigation is that while they clearly articulated the desire for their athletes to develop this mentality, they were much less clear in identifying their specific role in helping them to achieve it. This is a recurring theme with these young coaches and not surprising given the lack of coaching experience of the participants.

While development of an athletic mentality was a rich middle-order theme, two other lower-order themes contributed to athletic development. The lower-order theme of skill development was highlighted throughout the content analysis of athletic development. As an example, participants identified the development of skills as a salient piece of their coaching beliefs. For instance one PSC wrote, "Creating strong fundamental skills is a strong building block for the next level. A player can always get better, but getting better with the right skills can get you further" (PSC 6, line 76); while another added an age appropriate qualifier "When kids are just starting out it is important to attempt to develop their skills" (PSC 35, line 219). These PSCs recognized their role in physical skill development. The statements in this area reflected more concrete ideas of what they would focus on. The lower-order theme of supporting multiple sport experiences also merged into the higher-order theme of athletic development. This theme reflected a desire to minimize the specialization of young athletes and let them experience multiple sport environments. While this theme was infrequently reported, it was heavily emphasized by a few PSCs.

Personal development. Personal development was the second higher-order theme in the general dimension of Development. This theme consisted of raw data units that led directly to the higher-order theme of personal development. These data units consisted of character, personal growth, and personal development as most important in PSCs' coaching beliefs. "My coaching philosophy, along with most coaches, has many different aspects involving not just sport specific/goal coaching. Athletics is something that aids kids in their development as an overall person" (PSC 21, line 297). Creating a framework for positive youth development through sports programs has positive outcomes (Petitpas, Cornelius, Van Raalte, & Jones, 2005) and the PSCs in this investigation have been able to articulate their beliefs about the importance of this development.

Finally, there were those participants who identified the lower-order theme combining personal and athletic development to be a critical component of their coaching philosophy. The idea of developing the person as well as athletic skill appealed to these PSCs. For instance, one participant stated, "It is your job as a youth coach to provide not only skill/ability advise [sic], but also to shape that athlete into a respectable human being" (PSC 15, line 113). These PSCs recognized that personal and athletic development were not mutually exclusive and might actually be mutually beneficial. Personal and athletic growth and development is one of the role frame components (i.e., priorities reflecting philosophical beliefs that impact daily action) as described by Gilbert and Trudel (2004b) in their investigation of coaching behavior. These components are keys to a coach's approach to coaching.

Coaching education programs throughout the United States are based on creating a philosophy relative to three main principles in coaching: winning, development, and fun. Coaching educators encourage PSCs to think about these three main objectives and prioritize them appropriately. The PSCs in this study, while not explicitly stating as such, prioritized development. We draw this conclusion based on the holistic context of the written statements, as well as the repetitive nature of development in their philosophy statements. While these coaches were not able to articulate their specific role in development, they were able to address development as a salient construct.

Expectations

The next general dimension, Expectations, consisted of only one higher-order theme, behavioral expectations, and several lower-order themes that merged directly to the general dimension of Expectations.

Behavioral expectations. In relation to the higher-order theme of behavioral expectations, participants wrote about the appropriate representation of the school and community as well as the lower-order theme of adhering to rules and regulations on and off the field. For example, one participant wrote, "I would want them to represent themselves, their family and friends, their town, their school, and their team extremely well" (PSC 13, line 93). Recently, there has been an increase in the scientific research in applied sport psychology relative to principles of life skill development in sport (Danish, et al,, 2002; Dworkin, Larson, & Hansen 2003; Gould et al., 2006; Gould, Collins, Lauer, & Chung, 2007). One of the tenets in developing positive life skills in and through sport is the ability of coaches to not only set expectations, but also to hold athletes accountable (Gould et al., 2007).

In addition to the higher-order theme of behavioral expectations, PSCs also identified lower-order themes of performance expectations and expectations of effort as critical components of their philosophy. For example, the lower-order theme of performance expectations is exemplified in the following quote: "When we hit the ice for practice, it[']s work time and I expect my players to perform as best they can daily, knowing that physical

mistakes will happen regardless but mental mistakes are not acceptable" (PSC 26, line 342). The performance expectation was reinforced with an additional lower-order theme of expectation of effort. This is evident in this statement, "If you aren't going to show up willing to give 100% and in the right mental state then think twice about even showing up" (PSC 36, line 231). Athletes interpret beliefs about their ability based on beliefs and behaviors of significant others (Fredricks & Eccles, 2004). By conveying expectations about performance, coaches provide information relative to the ability of their athletes to meet such expectations. Further, by including expectations in their philosophy statements, these PSCs are laying the groundwork for the importance of effort in perceptions of ability.

While the PSCs were clear about the importance of setting expectations, a few also identified the importance of clearly communicating these expectations to their athletes. Therefore, convey clear expectations emerged as a raw data unit that carried directly to the general dimension of Expectations. For example, one participant noted: "A college level coach should have a basic philosophy of what he/she expects from his/her athletes on a day-to-day basis and they should make these foundations of their program clear" (PSC 20, line 171). Conveying clear expectations is arguably a component of effective communication. Bloom, Schinke, and Salmela (1997) investigated developmental components of communication with coaches. Their research identified the process of communication styles from the novice coach to the international elite coaches and found how communication styles are modified throughout one's coaching career. Further, when consulting with coaches and athletes, coaching educators identify enhancing communication as a common strategy for enhancing performance and team relationships. It is encouraging that the PSCs in this investigation were able to articulate the need for conveying clear expectations, as it is rare that novice coaches are cognizant of effective communication.

What was most interesting about the general dimension of Expectations was again the PSCs' lack of ownership in helping athletes to meet these expectations. For example, participants were clear in addressing the importance of conveying clear expectations; however, they did not address the coach's role in working towards meeting these expectations. This appeared to be a common theme among most of the general dimensions (with the exception of Coaching Behavior). PSCs were able to articulate their belief systems, but were unable to articulate the implementation of such beliefs. This is one of the most telling findings of this investigation and parallels research by McCallister et al., (2000) as the authors found a disconnect between stated beliefs and subsequent action. It is likely due to the fact that the participants in this investigation were either novice coaches or PSCs.

Fun

The general dimension Fun was by far the most concise of all the dimensions. Participants talked extensively about how fun was a critical component of their philosophy. There were multiple raw data units that all merged into the lower-order theme of fun. Subsequently, the lower-order theme of fun merged directly to the general dimension. This quote taken from one of the statements succinctly highlights this point, "I think most importantly behind all the fundamentals, the patience, the motivating speeches, it's really all about having a fun time" (PSC 23, line 315).

Coaches of all levels value fun. This finding was confirmed through this investigation. In all levels of sport, coaches need to be aware of the motives of their athletes. Understanding participant motives is arguably the first step in creating a positive sport experience. Fun or enjoyment has been found as a key component in a variety of theoretical models of participant motivation in sport psychology. The Competence Motivation Model (Harter, 1978) identifies enjoyment as central; Expectancy-value (Eccles et al.,1983) posits that positive affect impacts achievement related choices. Finally the Sport Commitment Model (Scanlan, Carpenter, Schmidt, Simons, & Keeler, 1993) indicates lack of enjoyment and satisfaction as key components in the decision to withdraw from sport. Whether planning to coach youth, high school, or college, participants in this investigation consistently identified fun as an important factor in their coaching beliefs. What is interesting to decipher in this context is not only the value of fun, but more importantly, how fun is defined. It is a positive finding that these PSCs were able to identify fun as a salient component in their philosophy, without the benefit of understanding how this consistently paralleled major theoretical foundations in sport psychology. Further, this finding is also consistent with major objectives in coaching education programs about prioritizing winning, fun, and development.

Life Lessons Learned Through Sport

The general dimension Life Lessons Learned Through Sport consisted of the two higher- order themes of *intra sport values* and *specific life skills gained through sport*. The research team defined intra sport values as general values that could be learned both in and out of the sport context. Specific life skills gained through sport, on the other hand, was represented by clearly identifying a specific life skill and the relationship with sport.

Intra sport values. Content analysis of the higher-order theme of intra sport values revealed lower-order themes of such values as fairplay, importance of hard work, sportspersonship, respect, learning sport values, learning responsibilities, and lessons of team dynamics. For example, this PSC identified a list of values that should start early in sport, "The youth level is the starting point to hard work and dedication, team work, fair play, and respect" (PSC 15, line 112). The development of such traits as respect, character, and responsibility are traits that are proposed to enhance a particular experience. These intra sport values were critical components of these PSCs' beliefs.

Specific life skills gained through sport. Alternately the higher-order theme of specific life skills gained through sport highlighted similar values in a more specific context. In relation to the higher-order theme of specific life skills gained through sport, such lower-order themes of discipline, positive team dynamics, appropriate stress, and positive affect, equitable treatment of others, commitment, dedication, and work ethic emerged. For example:

> Team unity at any level is great, but a lot of high school athletes will never play college or pro so being able to relay a message of unity, respect, and compassion for their peers will teach them life lessons (PSC 19, line 156).

Finally, content analysis also revealed a unique lower-order

theme of the importance of life lessons that led directly to the general dimension of Life Lessons Learned Through Sport. The coach's role in enhancing these life lessons was a theme that participants wrote about in their philosophy statements. For example, one stated, "For these reasons, I feel it is important for the coach to realize that his/her actions contribute to the lifelong lesson that sport teaches a child" (PSC 31, line 381).

Building life skills through sport is fast becoming a trend in the sport psychology and coaching literatures (Danish et. al, 2002; Dworkin, et al., 2003; Gould et al, 2006, 2007; Mahoney, Larson, & Eccles, 2005). Recent research has demonstrated a relationship between positive life skills and sport. What is less clear, however, is the exact nature and role of the coach in this relationship. Gould et al. (2006) identified the importance of having systematic and specific strategies combined with the foundation of a workable coaching philosophy for building positive life skills through sport. The PSCs in this investigation have begun with the first piece of the puzzle, which is identifying a coaching philosophy that directs life skill development. While Gould et al.'s (2006) research focused on veteran coaches, this group of PSCs has yet to learn how to implement such belief systems. Coaching educators need to be at the forefront in providing coaches with strategies to translate belief into behavior.

Relationships

The final general dimension was Relationships. Content analysis revealed a single higher-order theme of *coach-athlete relationships*, as well as multiple lower-order themes that merged directly into the general dimension.

Coach-athlete relationship. The higher-order theme of coach-athlete relationships consisted of lower-order themes of directional relationships from the coach to the athlete as well as the directional relationship from the athlete to the coach. Additionally, participants wrote about mutual coach-athlete relationships, which emerged as the third lower-order theme.

The coach to athlete directional relationship was an important factor in many of the participants' coaching philosophy. Of particular importance was the role of the coach in creating a positive relationship with their athletes. PSC 34 highlights this in the following statement, "I think it is important for coaches to relate to their players on a personal level, as well as a professional level" (line 213). When participants wrote about the lower-order theme of athlete to coach directional relationship, trust was a common finding. One participant stated this succinctly, "Athletes must be able to trust their coaches" (PSC 4, line 58). While directional relationships revealed important constructs of philosophy statements, the lower-order theme of mutually dependent relationships between the coach and athlete were also viewed as important, "If coaches don't genuinely care about the players than the players will not learn to trust or respect the coach in return" (PSC 18, line 148).

In addition to the higher-order theme of coach-athlete relationship, content analysis indicated significant lower-order themes of team relationships, mutual respect, and coach-parent relationships that merged directly to the general dimension of Relationships. The importance of team relationships was a recurring topic in this general dimension. From the raw data units of emphasizing team unity to the importance of teamwork and social cohesion, participants consistently referred to team relationships. As one participant noted:

> I want to try and get the message across to students the importance of a team, and working together as one. Many think it is about individual glory, but they need to understand that team comes before the individual, in any sport (PSC 12, line 82).

This finding is comparable to one of the key principles of Smith and Smoll's (1997) Coach Effectiveness Training. Their third principle relates to the importance of teaching coaches the benefits of enhancing cohesion and support among team members. The PSCs in this investigation were able to articulate their beliefs about the importance of team relationships. It is a positive finding that the statements of the PSCs in this study coincide with evidence in established coach training programs.

Finally, the unique lower-order theme of coach-parent relationships was important to the participants in this study. Being open to parent interaction was viewed as a critical component by one participant. PSC 24 emphasized this in the following statement, "Lastly, I would always be 100% fair with both the child and the parent and be open to new ideas and build a friendly relationship with the parents" (line, 325).

Relationships are a critical part of sport. Numerous investigations have examined the impact of coach-athlete relationships on a particular sport experience (Côté & Salmela, 1995; Gilbert & Trudel, 2004). While the participants in this investigation mirrored previous findings about building relationships, what is interesting to note is that again the PSCs, with few exceptions, were not able to articulate their role as a coach in systematically cultivating such relationships.

Conclusion

The development of a coaching philosophy has been highly touted as a key to success in coaching, yet few examinations have explored this concept. This investigation of PSCs' philosophies identified seven general dimensions including: Coaching Behavior, Defining Success, Development, Expectations, Fun, Life Lessons Learned Through Sport, and Relationships. These dimensions reflect commonly accepted constructs within coaching education and sport psychology and are regularly illustrated by highly experienced, model coaches on the sidelines. Despite their lack of coaching education and coaching experience, these PSCs were well versed in their beliefs about coaching and the positive impact that sport can have on participants. Sport psychology practitioners and coaching educators are the logical professionals to assist young coaches in creating that impact. While social desirability may have been operating to some extent, these coaches were fairly articulate in writing about their beliefs.

These results also highlighted a disconnect within their coaching philosophies. The PSCs' beliefs about coaching and their role as a coach in implementing their philosophy reflect a lack of congruence between belief and behavior. This reinforces the need for coaching education programs to provide young coaches with specific strategies for taking ownership and implementing their beliefs.

Future Directions

This investigation highlights the need for continued development of coaching education programs and coaching philosophy should be at the forefront of such programs. The present study focused on the beliefs of individuals who intend to enter the field of coaching. This group of participants draws attention to a potential limitation of the study. While a sample size of 35 participants is large for a qualitative investigation, it is hard to project how many of these participants will actually enter the field of coaching. Therefore, it will also be beneficial for future research to focus on the philosophical beliefs of early-career coaches. That is, identify coaches who are in their first or second year of coaching and discover the evolution of their coaching philosophy during these early experiences.

Further, research should aim to investigate the implementation and actions associated with a coaching philosophy. One of the significant findings of this study indicated that while these PSCs could articulate their philosophy, they were less sure of how to implement these beliefs. This finding opens the door for two areas of research. First, examining the quality of applied experiences provided in coaching education programs to identify whether PSCs are getting the opportunity to challenge their beliefs and find mechanisms for implementation. Second, tracking entry-level coaches as they develop skills to implement their philosophies would provide new insights into coaching education programs. Taking these steps will highlight which gaps in coaching education require greater exploration and development. Finally, future research on the actions associated with coaching philosophies will give coaching educators a clear indication of what is done well in coaching education, an important factor in the continued and systematic implementation of coaching education programs.

References

Abraham, A., & Collins, D. (1998). Examining and extending research in coach development. *Quest, 50*, 59-79.

Balaguer, I., Duda, J.L., & Crespo, M. (1999). Motivational climate and goal orientations as predictors of perceptions of improvement, satisfaction and coach ratings among tennis players. *Scandinavian Journal of Medicine and Science in Sports, 9*(6), 381-388.

Bloom, G. A., Durand-Bush, N., Schinke, R. J., & Salmela, J. H. (1998). The importance of mentoring in the development of coaches and athletes. *International Journal of Sport Psychology, 29*(3), 267-281.

Bloom, G. A., Schinke, R. J., & Salmela, J. H. (1997). The development of communication skills by elite basketball coaches. *Coaching Sport Science Journal, 2*(3), 3-10.

Burton, D., & Raedeke, T. D. (2008). *Sport psychology for coaches*. Champaign, IL: Human Kinetics.

Conroy, D. E., Kaye, M. P., & Coatsworth, J.D. (2006). Coaching climates and the destructive effects of mastery-avoidance achievement goals on situational motivation. *Journal of Sport and Exercise Psychology, 28*(1), 69-92.

Côté, J., & Salmela, J. H. (1995). The knowledge of high performance gymnastic coaches: Competition and training considerations. *The Sport Psychologist, 9*, 65-75.

Creswell, J. W. (2003). *Research design: qualitative, quantitative and mixed method approaches*. Thousand Oaks, CA: Sage.

Danish, S. J., Fazio, R. J., Nellen, V.C., & Owens, S.S. (2002). Teaching life skills through sport: Community-based programs to enhance adolescent development. In J.L. Van Raalte & B.W. Brewer (Eds.), *Exploring sport and exercise psychology* (pp. 269-288). Washington, D.C.: American Psychological Association.

Dworkin, J. B., Larson, R, & Hansen, D. (2003). Adolescents' accounts of growth experiences in youth activities. *Journal of Youth and Adolescence, 32*(1), 17-26.

Eccles, J., Adler, T., Futterman, R., Goff, S., Kaczala, C., Meese, J., & Midgley, C. (1983). Expectancies, values, and academic behaviors. In J.T. Spence (Ed.), *Achievement and achievement motivation* (pp. 75-146). San Francisco, CA: Freeman.

Fredricks, J. A., & Eccles, J. S. (2004). Parental influences on youth involvement in sports. Developmental sport and exercise psychology: a lifespan perspective. In M.R. Weiss (Ed.), *Developmental sport and exercise psychology: A lifespan perspective* (pp. 145- 164). Morgantown, WV: Fitness Information Technology.

Gilbert, W. D., & Trudel, P. (2000). Validation of the coaching model (cm) in a team sport context. *International Sports Journal, 4*(2), 120-128.

Gilbert, W. D., & Trudel, P. (2004a). Analysis of coaching science research published from 1970-2001. *Research Quarterly for Exercise and Sport, 75*(4), 388-399.

Gilbert, W. D., & Trudel, P. (2004b). Role of the coach: How model youth sport teams frame their roles. *The Sport Psychologist, 18*(1), 21-43.

Gilbert, W. D., & Trudel, P. (2005). Learning to coach through experience: Conditions that influence reflection. *Physical Educator, 62*(1), 32-43.

Gould, D. R., Collins, K. E., Lauer, L., & Chung, Y. C. (2006). Coaching life skills: A working model. *Sport and Exercise Psychology Review, 2*(1), 10-18.

Gould, D. R., Collins, K. E., Lauer, L., & Chung, Y. C. (2007). Coaching life skills through football: A study of award winning high school coaches. *Journal of Applied Sport Psychology, 19*(1), 16-37.

Harter, S. (1978). Effectance motivation reconsidered. *Human Development, 21*, 34-64.

Horn, T. (2008). Coaching effectiveness in the sport domain. In T.S. Horn (Ed.), *Advances in Sport Psychology* (pp. 239-267). Champaign, IL. : Human Kinetics.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Newbury Park, CA: Sage.

Mahoney, J. L., Larson, R. W., & Eccles, J. S. (Ed.). (2005). *Organized activities as context for development: Extracurricular activities, after-school and community programs*. Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Martens, R. (2004). *Coaches guide to sport psychology*. Champaign, IL: Human Kinetics.

McCallister, S. G., Blinde, E. M., & Weiss, W. M. (2000). Teaching values and implementing philosophies: Dilemmas of the coach. *Physical Educator, 57*(1), 35-45.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis*. Newbury Park, CA: Sage.

Ntoumanis, N., & Biddle, S. .J. (1999). A review of motivational climate in physical activity. *Journal of Sport Sciences, 17*(8), 643-665.

Patton, M. Q. (1990). *Qualitative evaluation methods (2nd ed.)*. Beverly Hills, CA: Sage.

Petitpas, A. J., Cornelius, A. E., Van Raalte, J. L., & Jones, T. (2005). A framework for planning youth sport programs that foster psychosocial development. *The Sport Psychologist, 19*, 63-80.

Pratt, S. R., & Eitzen, D. S. (1989). Differences in coaching philosophies between male coaches of male and female basketball teams. *International Review for the Sociology of Sport, 24*(2), 151-159.

Scanlan, T. K., Carpenter, P. J., Schmidt, G. W., Simons, J. P., & Keeler, B. (1993). An introduction to the sport commitment model. *Journal of Sport and Exercise Psychology, 6*, 208-226.

Smith, R. E., & Smoll, F. L. (1997). Coaching the coaches: Youth sports as a scientific and applied behavioral setting. *Current Directions in Psychological Science, 6*(1), 16-21.

Smoll, F. L., & Smith, R. E. (2002). Coaching behavior research and intervention in youth sports. In F. L. Smoll & R. E. Smith (Eds.), *Children in sport: A biopyschosocial perspective* (pp. 211-234). Dubuque, IA: Kendall/Hunt Publishing.

Trudel, P., & Gilbert, W. (2006). Coaching and coach education. In D. Kirk, M. O'Sullivan, & D. McDonald (Eds.), *Handbook of research in physical education* (pp. 516-539). London: Sage.

Vealey, R. (2005). Beyond shrinks: What coaches should know about

mental training. In R. Vealey (Ed.), *Coaching for the inner edge* (pp. 131-148). Morgantown, WV: Fitness Information Technology.

Weiss, M. R. (2004). *Developmental sport and exercise psychology*. Morgantown, WV: Fitness Information Technology.

Weiss, M. R., & Williams, L. (2004). The why of youth sport involvement: A developmental perspective on motivational processes. In M.R. Weiss (Ed.), *Developmental sport and exercise psychology: A lifespan perspective* (pp. 223-268). Morgantown, WV: Fitness Information Technology.

Wilcox, S., & Trudel, P. (1998). Constructing the coaching principles and beliefs of a youth ice hockey player. *Avante, 4*(3), 39-66.

Wilson, K., Hardy, L., & Harwood, C. (2006). Investigating the relationship between achievement goals and process goals in rugby union players. *Journal of Applied Sport Psychology, 18*(4), 297-312. ■

Engaging Experiential Service Learning Through a Co-Curricular Club: The Chase Charlie Races

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Abstract

The efficacy of the *Chase Charlie Races* (an experiential learning activity) was demonstrated via program assessment. This was achieved via post-event evaluations of race participants and student club members, and with fitness assessments of 76 elementary students who participated in an eight-week training program. Paired sample t-tests revealed significant differences between the pre-test (M = 11.9 laps, SD = 7.3) and post-test (M = 21.3 laps, SD = 11.5) scores $t = 9.504$, $p < .001$. Beneficial outcomes from this learning experience were identified for stakeholders including the students, faculty sponsors, the co-curricular club, the university, and the community.

Key words: event planning, sport administration

Introduction

As the relatively young academic discipline of sport management continues to seek credibility from the academic community and sport practitioners, the conversion from theoretical knowledge in the classroom to practical applications in the work environment resounds as a meaningful area of study for sport management educators (Cuneen & Parks, 2001; Danylchuk & Boucher, 2003; Pitts, 2001). Sport industry practitioners have noted that a student's field experience is the most important part of their academic training (Petersen & Pierce, 2009). Through this type of experience, theory and practice are fused by bestowing students with knowledge, critical thinking skills, and expertise before sending them out into the industry (Cuneen & Parks, 1997). Theoretical considerations of experiential learning in sport management have developed over nearly 15 years (Gladden & McDonald, 1999; Pauline & Pauline, 2008; Southall, Dick, & VanStone, 2008; Southall, Nagel, LeGrande, & Han, 2003;).

Parkhouse (2001) identified two types of experiential learning activities: non-discrete and discrete. Non-discrete activities are extensions or components of a specific academic course or program. Southall et al. (2003) identified several non-discrete applications in sport management such as field projects, field trips, interviews, site visits, and role play activities. Discrete activities are self-contained and constitute a separate entity from the traditional on-campus educational setting. Discrete learning within the sport industry setting allows sport management students to make the connection between cognitive classroom theories and concrete sport management experiences. Examples of discrete learning experiences include cooperative education, field study, internships, and service learning programs (Parkhouse, 2001).

Service learning is a method of teaching where students apply their academic skills and knowledge to address real-life needs in their own communities. Service learning is a pedagogical strategy that facilitates a student's growth in academics, social maturity, critical thinking, communication, collaboration, and leadership skills (Meyer, Hofschire, & Billing, 2004). This educational opportunity possesses enormous potential to move higher education in the direction of civic involvement by taking the classroom into the community. Service learning includes an intentional and structured educational/developmental component for students, and is most typically employed in curricular settings for academic credit. However, service learning opportunities can also be implemented in co-curricular settings. Co-curricular activities are school sponsored activities or clubs that are another part of the educational process that exist outside the realm of credit-driven courses, internships, or other field-based practicum. Cocurricular clubs formed around various academic majors is a common element within undergraduate education. The co-curricular club program can be viewed as a training ground for participation in fundamentally similar organizations such as professionals (Hlebowitsh & Wraga, 1998). Clubs have the capacity to underpin the goal of teaching students to be responsible via the implementation of learning opportunities that develop character, critical thinking, social skills, and talents (National Association of Secondary School Principals, 1996). As such, the utilization of a sport management club to engage students in service learning can assist in the achievement of valuable outcomes for the students, the faculty, the university as a whole, and the community at large.

The *Chase Charlie Races* are an example of a specific community-centered service learning initiative with an innovative approach to educating sport management students by combining experiential learning and service learning in a co-curricular club sponsored activity. The *Chase Charlie Races*, organized by a Midwest State University Sport Administration Club, is an annual community event in a small Midwestern city, founded in 2000 to promote fitness and wellness in the face of growing childhood obesity rates. The event includes three race components: the *5K run, walk, or roll* for all ages; a 1 mile run for youth 13 and under called the *Mile Mania*; and the *Kiddie 100*, a 100-yard dash for children 8 and under racing the university mascot across the game field during halftime (Pauline & Pauline, 2007).

Teaching event management skills to future sport administrators is the professors' primary concern as the *Chase Charlie Races* event is designed to help the students to apply the managerial concepts they learn in a variety of sport administration courses. Equipping students with hands-on experience is imperative to preparing students for success in the field. When hands-on experiences can add value for the faculty sponsors, the university, and community in addition to the students, then the impact of the program is magnified. The purpose of this paper is to present the *Chase Charlie Races* project as a model pedagogical strategy that can assist sport management educators when applied in various settings to achieve broad educational objectives. Although currently applied

within a sport management setting, this methodology could have broad applications across many disciplines seeking to impact their communities in the areas of fitness and wellness, and to combat the growing trend of obesity. Beneficial outcomes will be examined for each stakeholder group including the students engaged in the project, the faculty sponsors providing project guidance and oversight, the co-curricular club responsible for managing the project, the university, and community members participating in the event.

Method

Participants

Three groups of participants were examined in this paper: students in the co-curricular club responsible for implementing the service learning project, community members participating in the *Chase Charlie Races*, and children participating in the after-school running program. There were 72 university students ranging in ages from 18 to 23 (M = 20.27, SD = 1.69) involved in the service learning project that were divided into 7 working subgroups (see Table 1). There were 277 participants competing in the 5K race ranging in ages from 11 to 65 (M = 30, SD = 13). A total of 82% came from the local county (home of the university) and there was a 57% female participation rate. Additionally, 76 children from the university laboratory elementary school participated in the after-school program, with ages ranging from 9 to 11(M = 9.70, SD = 0.58), with a 58% male participation rate.

Instrumentation

The *Chase Charlie* 5k race was evaluated across three spectrums. First, survey instrument I was distributed to race participants after the conclusion of the event. Survey instrument I contained 14 questions each written at an elementary school reading level. Of the 14 questions 12 were multiple choice questions: two questions acquired demographic information (age and gender), four items assessed previous exercise activity, four questions assessed participants' opinions regarding race effectiveness, and two questions assessed participants' opinions according to educational opportunities related to wellness and healthy active lifestyles. Two questions were open-ended. The first asked participants about perceived drawbacks and how they might change the race for the future, while the second assessed perceived benefits from the race. Content validity was established in two ways. The survey was reviewed by experts for clarity and construction of the questions, and only minor editing was required to improve the clarity of the questions. Wording of the questions was designed to include descriptive information to counteract against misunderstanding of key terminology. Response choices were similarly worded to maximize participant comprehension; previous research using similar questions did not reveal any difficulty with participant comprehension.

Second, survey instrument II was distributed to 10 students in the leadership group of the co-curricular club. Survey instrument II contained seven items (see Table 2). Components of the evaluation led students to examine the success of the event, analyze the results of the post-event survey, and compare and contrast their real-life experience with the theoretical knowledge that they previously obtained in sports administration classes.

Third, the *Chase Charlie Mile Mania* after-school running program was evaluated via a traditional pre-test and post-test protocols via the PACER (Progressive Aerobic Cardiovascular Endurance Run) test. The PACER test, also known as the multi-stage fitness test, is used to assess cardiovascular fitness via a test of an athlete's VO_2 max or aerobic capacity. Athletes jog and/ or run between two points that are 20 meters apart to a set of synchronized beeps at intervals that gradually decrease (Welk & Meredith, 2008). The highest level attained before failing to keep

Table 1. ***Student Groups and Responsibilities for the Chase Charlie Races***

Group	Pre-Race	During Race	Post-Race
Marketing	Implement strategies to reach target markets: students, local schools, past participants, local community	Help course marshals	Help tabulate post-race surveys
Sponsorship and Fundraising	Solicit sponsorship and gifts for participants	Sponsor fulfillment	Thank sponsors and contributing businesses
Registration	Database management, create registration bags	Walk-up and pre-registration process	Prepare database for next year, final report on participation stats
Operations	Road closure, staffing assignments, race course design, acquire supplies	Starting line, on-course directions, signage and banners finish line, timing and results	Cleanup, awards distribution, food and drink
Financial Management	Create budget, monitor budget, deposit funds, reimburse expenses	Collect walk-up registration fees, deposit cash and checks	Create final financial statement
Public Relations	Update website, press release, public service announcement, coordinate media appearances	Photography	Press release, update web with race results, post-race surveys
Creative Services	Web design, registration brochures branding, t-shirt design, signage, awards/trophy design	Distribute nutritional information and athlete training tips	Answer any follow-up emails from participants

Table 2. ***Summary of the Student Evaluation Questions to Assess Student's Perception of the Event Management Experience***

1.) Did you apply concepts you learned in class when managing Chase Charlie?
2.) Do you feel the experience you gained in managing Chase Charlie will apply to future career opportunities?
3.) Would you feel comfortable in an event planning management position following graduation?
4.) Give an example when you used critical thinking to solve a problem that arose during Chase Charlie?
5.) In what ways is having the club operate Chase Charlie beneficial for students in the Sport Administration program?
6.) What could be changed to make Chase Charlie a more valuable learning experience?
7.) How many total hours did you spend working on Chase Charlie this year?

pace with the beep tempo is recorded as the score for that test.

Procedures

The timeline to plan both the *Chase Charlie Races* as well as the *Mile Mania* after-school running program began in January and February of 2009 when faculty members involved with the project sought internal (associated with the university) and external grant funding opportunities. Through March, April, May, and June faculty members wrote and submitted grants to aid in funding race and after-school program materials. The *Chase Charlie Races* have obtained past grant funding from sources such as: Campus Compact, State Association for Health, Physical Education, Recreation and Dance; Ball Brothers Foundation, and the ING/ NASPE Run for Something Better. This project has garnered six separate grants with a mean value of $2,447 per grant.

In the first week of June, faculty met with Sport Administration club officers to discuss both upcoming projects. Faculty and students established a critical task analysis for the *Chase Charlie Races* and the after-school program. October 16th was set as the official race day and the full club membership would begin planning the *Chase Charlie Races* at the beginning of the fall term eight weeks prior to the race day. The after-school running program was also planned to be eight weeks long in duration. In this initial planning session, both faculty and club officers visited county elementary schools to develop connections with physical education teachers and principals interested in the project.

On June 15-25, faculty visited the American College of Sports Medicine (ACSM) and National Institute of Fitness and Sport (NIFS) in Indianapolis to review literature and discuss after-school program design. During the last week of June, faculty selected the running program host school (University Laboratory Elementary School), finalized program goals in conjunction with school input, developed instructional strategies, assessment forms, initial marketing and participant recruitment signage.

Beginning in July and continuing through September, students from the Sport Administration Club solicited local sponsorships for the *Chase Charlie Races*. On July 21, faculty met with the Lab School physical education teacher and principal to review all draft materials for the after-school running program.

In August, faculty obtained racecourse approval and road closures. The Sport Administration Club also met and developed 7 sub-committees in order to cover the race planning (see Table 1). In the first week of August for the after-school program, faculty developed the common teaching/training modules for Sport Administration students administering the project. Starting August 8-13, faculty members finalized all program materials with the host school personnel and obtained final review and approval of all program and marketing components. From August 1418, faculty conducted university student training in order to ensure an effective program implementation. On August 20, students and faculty opened the "Elementary School Student Participant & Parent Meeting" to conduct final sign-ups, program participant orientation, and to obtain permission forms/waivers for all participants and parents. On August 23rd, Sport Administration students launched the program at the Lab school (four times a week for eight weeks) and also conducted the initial pre-test PACER fitness assessment. Seventy-six students participated in an eight-week training program. The training sessions included a combination of various fitness activities, games and running workouts. During the workout sessions, the boys and girls participated in a variety of running activities that utilized a game or a team goal. For example, sessions to build cardiovascular endurance such as the "10-minute turkey trot" or the "buddy run" were interspersed with sessions to build flexibility or speed and agility such as "run and stretch" or "steal the pin" or "the cone game".

In September, Sport Administration Club students established the *Chase Charlie Race* event budget, continued soliciting sponsorships, began to accept online and paper registration for the race, implemented public relations and marketing, and recruited additional volunteers within the club to help with event operations. Students also continued to administer the after-school running program to the laboratory elementary students.

In October, Sport Administration students continued the race projects started in September, but also purchased and obtained donations for race supplies. During this time, students continued to implement the after-school running program and began to register the after-school running program participants for the *Mile Mania* portion of the *Chase Charlie Races*. On October 16, Sport Administration students as well as faculty conducted the 2009 *Chase Charlie Races* and *Mile Mania* for community registrants and after-school running program participants. The survey instrument hyper-link was distributed via flyers to all race participants and a follow-up email was sent to race participants that had registered their email addresses. The introductory email explained the purpose of the study and provided the hyperlink to the web-based informed consent and survey instrument. Survey instrument II was administered to the student and faculty participants post-race. On October 25, final PACER fitness testing was conducted for those participating in the after-school program. The researchers' University Institutional Review Boards approved all of the procedures.

November responsibilities included event settlement and wrap-up. Inventory and final finances were assessed and running program awards were distributed to the laboratory school students. Faculty

sponsors of the event also reported results to grant agencies.

Data Analysis

A mixed methods approach was employed to analyze the data. Descriptive statistics were used to analyze multiple-choice components of survey instrument I. Paired sample *t*-tests were employed to analyze PACER fitness data retrieved from the after-school running program. Open-ended responses from both survey instruments were analyzed with the qualitative method of content analysis (Krippendorff, 1980; Tritschler, 2000). This content analysis included response review, identification of themes, and classification of responses according to the identified themes thereby giving voice to the viewpoints expressed regarding the *Chase Charlie Races*. This qualitative data adds further depth of discovery regarding key issues surrounding the event. Quantitative analyses were conducted with a modern statistical software package (SPSS version 17.0 for Macintosh). Statistical significance for all analyses was established a priori at alpha < . 05.

Results

The effectiveness of the *Chase Charlie Races* was demonstrated via program assessment. This was achieved via post-event evaluations of race participants (survey instrument I), fitness assessments of 76 elementary students who participated in an eight-week training program (PACER), and a survey of club members participating in the project (survey instrument II). Survey instrument I administered to *Chase Charlie Race* participants drew a 38.2% response rate. The event marketing feedback revealed that 37% initiated entry due to flyers and 32.9% heard from personal/friend invitation. Of the race participants, 28% were repeat participants from prior years, 23.8% were participating in an organized run or walk for the first time and 88.9% would either definitely or likely participate in the event again. The highest number of racers (41.8%) suggested including a health/wellness fair associated with the race, 29.9% suggested formal exercise classes, 20.9% suggested fitness/wellness web resources, 19.4% suggested informal exercise groups, and 11.9% suggested additional fitness/wellness brochures or booklets.

Seventy-six students participated in an eight-week program that included pre-training and post-event fitness testing via the 20-meter version of the PACER test (Table 3). Paired sample t-tests revealed significant differences between the pre-test (M = 11.9 laps, *SD* = 7.3) and post-test (*M* = 21.3 laps, *SD* = 11.5) scores $t = 9.504$, $p < .001$. Based upon the Fitness Gram standard (Welk & Meredith, 2008), the male participants were below the healthy fitness zone for the PACER assessment at the beginning of the training period and progressed into the middle of the healthy fitness zone by post-event (pre: *M* = 12.9 laps, *SD* = 9.0; post: *M* = 24.2 laps, *SD* = 13.9). The female participants progressed from the very bottom of the healthy fitness zone towards the middle by post-event (pre: *M* = 11.8 laps, *SD* = 7.0; post: *M* = 15.5 laps, *SD* = 7.5). Although the males demonstrated greater increases in PACER performance during the training, both genders' changes were independently significant ($t = 4.6$, $p < .001$).

Table 3. ***PACER Test Data Summary and Paired t-Test Results***

Item	Pretest Score		Post Test Score
Number of Pairs		76	
Mean	11.9		21.3
Standard Deviation	7.3		11.5
Difference in Means		9.4	
t - value		9.504	
Degrees of Freedom		75	
Significance		>.001	

Qualitatively, five themes emerged from the combination of open-ended questions from both survey instruments. Students, faculty, co-curricular clubs, university/schools, and community participants represent the five stakeholders benefiting from this type of service learning project. Components of the evaluation led students to examine the success of the event, analyze the results of the post-event survey, and compare and contrast their real-life experience with the theoretical knowledge that they previously obtained in sport administration classes. The ways in which the students benefitted in their own words are presented in the discussion section.

Discussion

Program Evaluation

The efficacy of a learning experience like the *Chase Charlie Races* or any experiential learning activity must be demonstrated via program assessment and evaluation. The *Chase Charlie Races* are assessed and evaluated in several different ways. This evaluation process was completed using several direct measures such as: results of the PACER test, event participation levels, participant feedback and surveys, external funding support via grants and sponsorship, and feedback from the club member event volunteers and leaders. The PACER test is possibly the most commonly used endurance fitness test conducted around the world and can be used to gauge the effectiveness of the *"Chase Charlie Races"* preparation program. Based upon the Fitness Gram standard, the male participants were below the healthy fitness zone for the PACER assessment at the beginning of the training period and progressed into the middle of the healthy fitness zone by the end of the program (Welk & Meredith, 2008). The female participants progressed from the very bottom of the healthy fitness zone towards the middle of the zone at the conclusion of the program. Although the males demonstrated greater increases in PACER performance during the training, both genders' changes (improvements) were independently significant. The *"Chase Charlie Races"* preparation program not only physically prepared participants for the race but also educated participants on important health and fitness issues. This educational component was positively reflected in post event survey results as the running program and race participants played a significant role in the evaluation. To close the feedback loop, it is important to examine how the participants of the *Chase Charlie Races* felt about the overall experience and how participation numbers compared with estimated numbers or past events.

Every race finisher was asked to fill out an online questionnaire evaluating the experience on topics such as the experience, value, importance, and repeat attendance expectations. The online post-event participant survey served as an important teaching tool for

faculty mentors and provided key management insights for the student leaders of the club. The post-event survey data described above demonstrates some of the key applications for event improvement via assessment and evaluation.

Not only did the race participant evaluation measures offer great feedback to improve the *Chase Charlie Races* and to increase future participation, but the professors involved with the project also used the post-race evaluation as a learning tool for the students. The professors met with the club executive board and had a debriefing meeting following the event. Many of the administrative decisions that were made regarding the event were compared with the results of the post-race survey. Specific areas such as advertising, marketing strategy, target market, race day administration, sponsor gift bags, health and fitness educational materials and overall participant satisfaction were compared to the participant's post-race survey and the concepts taught in the classroom.

Student Benefits

In order to directly assess the impact of this event on the students and student leaders, a post-event survey was developed to allow for reflective thinking and writing about the project. The general responses to the student leader post-event evaluation were also supported in prior studies. Furco (2002) found differences on the formulation of career plans and emphasis on finding a career that was personally satisfying and/or beneficial to others between the service-learning and service groups and the non-participants. This service learning experience indeed demonstrated positive impact on the future paths of students participating in the project. Students commented:

> I most definitely feel that the experience I have gained through *Chase Charlie* will benefit me in future career endeavors. In this industry, any experience you can gain is extremely valuable, and I feel the experience gained through *Chase Charlie* will be extremely valuable moving forward in my career;
>
> "Yes, I think this experience is more than a resume builder. It was a great experience for me and will allow me to execute future events;" and
>
> There are several reasons *Chase Charlie* is beneficial for club members. It gives us work experience that cannot be gained in the classroom. In this industry, immersive learning and relative work experience is key to moving forward in the industry.

According to Milner (1995), consumer based projects or events provide students a more actively comprehensive learning experience than role playing or simulated learning approaches. This proved to be the case for the 75 sport administration club students utilized throughout the course of planning and implementing the *Chase Charlie Races*. First, the students benefited from working in a fully authentic project that was completely implemented by the co-curricular club organization. As a voluntary co-curricular based experience, the level of motivation and ownership for the student organizers was very high, and likely much greater than if mandated via a course-based project; therefore, the level of engagement and positive learning outcomes were enhanced. The co-curricular setting also provided the opportunity for freshman and other underclassman to become directly involved in the event operations for multiple years and allowed upperclassman the opportunity to assume leadership roles within the event. Student leaders developed skills in the delegation of work responsibilities under the guidance of faculty mentors in the areas of marketing, community outreach, fundraising, sponsorship, public relations, creative services, operations, and registration. Students commented:

> It allows people in the club to get involved outside of class and receive some event management experience. I like how we split into the only groups that would give people something to do (like fundraising and marketing) at the beginning of the semester, and waiting until closer to the event when we split into groups for operations and registration. I think it makes them feel like they're actually helping out when they're given a task to be responsible for, whether it's hanging up fliers, looking for donors, or being a directional person on the racecourse.
>
> "The most rewarding experience of the project for me was when I saw the t-shirt and saw sheriff Goslin's logo on the back. That was the sponsorship that I got for the race."
>
> "I got to gain some experience doing things that are not usually offered by a college course and to sell and purpose sponsorships as well as work event day operations."
>
> I have learned that I enjoy trying to sell things. When I went to different hotels it was fun for me because I think of it as a challenge. I hope to learn more about the art of selling and see if I have a knack for it that I want to.
>
> "Seeing my hard work on the T-shirt design come to life and seeing people a day or two later wearing the shirt knowing that I made it."

Students also benefited from operating within a realistic community sport setting; the activities and skills developed directly relate to what many students will face in their future internships or careers. For example, students worked in small functional groups led by a student who also served as a member of the sport administration club executive board. All of the students in the sport administration club were allowed to choose the group they wanted to work with. The largest and most popular group was the operations group, which included approximately 40 students. Each one of the students worked with group members in a collaborative effort to prepare their assigned tasks for the upcoming event. Each of the five group leaders were charged with organizing the tasks for each member, and the leaders prepared and delivered progress reports at weekly executive board meetings of the club. For example, one of the tasks of the marketing and promotion group was to develop the marketing plan that would be used by the club for the event. This group work environment simulated the realistic climate of a sport-marketing firm working for a client. The student group was responsible for the creation and implementation of a marketing plan that was used to market the event to the university,

local community and the surrounding metropolitan area.

The students also benefited from the highly interactive roles with key leaders including the advising professors, the administrators within the university athletic department, and educational and civic leaders in the community. These professor and leader/administrator roles become less distinct and separate and can often develop more into a mentorship role within these types of learning environments (Southall et al., 2003). When professors and students work together on a project instead of restricting their relationship to teaching and learning, the relationships are then enhanced upon returning to the classroom setting. This again benefits the student and student-learning process. Students commented:

> "I like how we had the freedom to get tasks done the way we wanted to"
>
> "Working with a professor outside of class was a new experience"
>
> We are responsible for every aspect of the event. It gives us the chance to take charge, to delegate, to get the behind the scenes look at things. If something goes wrong, we have to work with the professors to figure a way to fix it.

As Overton and Malinauskas (2007) concluded, the implementation of service learning into the sport management curriculum is one avenue that enables students to experience the internal operations of a sport organization and be an avenue of preparation for their internship. Students deepened their social interaction skills by working in a team setting for this experiential program. Furco (2002) found significant differences between service and service-learning participants and nonparticipants on all measures of ethics, with far more positive ratings for those who participate in service or service-learning. It is expected that similar outcomes from an ethical decision-making perspective would be developed with the student participants in this event. Students additionally benefitted from the project by leveraging this "real world" experience into a resume enhancement, as several students in the program said this experiential service-learning project was added as a prominent entry to their resumes.

Faculty Benefits

The faculty involved with the project took an ambitious approach to teaching within this project by moving outside the traditional curriculum and launching this community-based service-learning project through a co-curricular club. This experiential service-learning project was developed to establish and enhance relationships with the community. As a result, the faculty created strong connections with school principals throughout the county, with coaches and physical education teachers within six school districts, and with leaders in the local YMCA. These relationships opened the door to sustain this particular project and to provide a foundation to establish future ventures.

By anchoring this learning experience in a real-world project, it naturally served to pull participating faculty members in the direction of functional and conceptual integration. Indeed, over and beyond such integration, it promoted new opportunities for dialogue among disciplinary participants. Enhanced collegiality and communication amongst the educational leaders involved created an additional benefit for the faculty in the use of service-learning programs.

This methodology creates a new and energizing service-learning environment where the faculty involved will continually modify and enhance teaching methods to meet the student and project needs (Swanson, & Gwinner, 2008). In this type of program, the faculty sponsors typically become a facilitator through five roles: setting a positive learning climate, clarifying the learner(s) purposes, organizing the learning resources, balancing intellectual and emotional learning components, and sharing thoughts and feeling with learners without dictating attitudes and beliefs (Rogers & Freiberg, 1994). The project also fostered the development of a strong professional relationship between the faculty sponsors and the primary contacts of the athletic department. For example, the *Chase Charlie Races* nurtured a strong working relationship between the faculty sponsors and leaders of the Ball State University athletic department including assistant athletic director for operations, director of facilities, director of marketing, and the director of ticket sales. The working relationships fostered dialogue that enhanced the faculty sponsors' knowledge base for this and other industry segments. Additionally, this experiential program created an avenue for pedagogical research in the growing area of sport management education. The launch of the *Sport Management Education Journal* in 2007 demonstrates the increased interest and value of these pedagogical lines of scholarship within the field of sport management.

Due to the nature of this event as community service seeking to impact the obesity issue, there were many opportunities to obtain external grant funding. This benefitted faculty sponsors in developing grant writing and grant management experience. As a student-led service learning community event, additional corporate sponsorship funding opportunities also arose from the races. This funding allowed for reduced cost event entry fees and for the generation of event profits to fund other club or academic opportunities as well as to provide charitable contribution to community organizations aligned with the event goals. Reducing the cost of participation was important during tough economic times. Eighty percent of the participants in the *Chase Charlie Races* were from the city in which the University was based where the personal per capita income in 2010 was $26,825 and 29.2% of the students received food stamps (Indiana Quick Facts, 2010). As the opportunities for outside funding and resource development in the academic field of sport management are typically quite limited and competitive, it remains challenging for faculty to meet this job expectation in a research-focused institution (Pauline & Pauline, 2008). The *Chase Charlie Races* aided faculty pursuit for grant-funded projects by initiating a revenue stream that proved vital to the overall scholarly productivity of the faculty leaders.

Co-Curricular Club Benefits

The co-curricular club reaped benefits from the partnerships created through a well-structured experiential service-learning project. Within the *Chase Charlie Races*, the cocurricular club officers were able to make direct contact with an entire class of sport management students via class presentations to the academic

major's introductory class of 100 students and to students attending weekly club meetings. During the second week of classes the sport administration club held an organizational meeting for the *Chase Charlie Races*. This meeting allowed for the co-curricular club to inform the students of their organization and future opportunities. Student group leaders were engaged in face-to-face, direct email, and phone contact with local businesses throughout the project. Due to the amount of sponsorship money gathered and the high volunteer hours logged, the project required a relatively low monetary investment by the co-curricular club; a benefit to any student organization. Funds raised through the event were invested both in further club activities and events and for support to community agencies and programs aligning with the goals of the *Chase Charlie Races* event. For example, the club was able to make a donation to the local YMCA in the amount of $1,000 following the most recent event.

University Benefits

In addition to student, faculty, and club benefits, in many instances the university can benefit from the experiential service learning project. Evidence is beginning to confirm that service learning can enhance the achievement of the university curricular goals within the courses where the methodology is utilized (Strage, 2001). Besides enriching teaching and learning, service learning can build reciprocal partnerships within the local community and can extend university resources beyond the boundaries of the campus. For example, a state university in the Midwest has recently taken an innovative approach to education. University officials have adopted the slogan, "education redefined" and, along with it, have made an effort to support immersive learning, which is a 7-element adaptation of cross-disciplinary experiential learning (Ball State University, 2007). Enhanced technology utilization was another university-wide goal addressed through the *Chase Charlie Races*. The development and use of the student-created website ChaseCharlie.com for the event met this university-wide goal. This alignment with key elements of the university's strategic plan also greatly increases the likelihood of garnering internal grants and funding to either start-up or bolster any projects in existence. The visibility of the university and the students directly in the community also increases the *Chase Charlie Races* value on a university-wide scope. Finally, the project created externally funded revenue streams. Although the initial grant for the event was not extremely large, this type of contractual funding does return indirect costs back to the university to further support the contract and grants area infrastructure. A growing number of American universities have increased expectations for faculty to augment their salaries or develop external financial resources through additional programs or activities (Sowell, 1993). Traditional grant funding is often limited in the sport management discipline thereby increasing the impact of this grant funding.

Community Benefits

In society today, including the local community, choosing healthy behaviors, including physical activity and a low fat diet, are not practiced to the degree that they should be. Recent data ranked Indiana 12th among all states in the United States with 61.3% of adults either overweight or obese (Centers for Disease Control and Prevention, 2006). Unfortunately, obesity is not only an issue for adults as the number of children who are overweight had doubled in the last three decades (Ogden et al., 2006). In the face of the growing childhood obesity epidemic, parents and educators in the county were asking for more health awareness and resources in support of youth development efforts. Therefore, community events or programs, which provide opportunities for physical activity, can be very beneficial to maintaining an active lifestyle for children and adults (Pauline & Pauline, 2007).

The *Chase Charlie Races* were specific community-centered initiatives with an innovative approach to address growing health concerns in the county. Augmented opportunities for social education in non-formal settings, like sport, have implications for community agencies and institutions (Judge, Petersen, & Lydum, 2009). According to the United States Department of Health and Human Service Healthy People 2010 report (2010) only 22% of adults engage in moderate physical activity for 30 minutes five or more times a week and nearly 25% of the population is completely sedentary. In addition, only about 25% of young people (ages 12-21) participate in light to moderate activity nearly every day (Troiano & Flegal, 1998). Lack of physical activity continues to contribute to the high prevalence of overweight individuals and obesity within the United States. Because of the gravity of the youth obesity epidemic, *Mile Mania* and *Kiddie 100* participation is of supreme importance to the community. Instilling the importance of physical activity, teaching youth how to perform, making it convenient and enjoyable, are also important and obtainable goals from such a project. These would make it more valuable to the community and society.

The *Chase Charlie Races* targeted participants of all races, genders, classes, and abilities, in the county and local community. Gaining a clear understanding of the needs of the community has made the Chase Charlie event a continually growing success. The *Chase Charlie Races* promoted the core values of legacy, philanthropy, integrity, and effectiveness (Ball Brothers Foundation, n.d.). The races promoted "legacy" by emphasizing the continuity of involvement in both the annual race and healthy exercise, and seeking to build the community. They incorporated students and professors from Ball State and all members of the community with nearly limitless participation availability. The "philanthropy" value was the very mission of the activity. The project directors were passionate about increasing youth participation and setting positive health-related goals for youth participants through competition and education. Sportsmanship acts as the "integrity" value in the event. The races created an atmosphere of fair competition for community members where competitors displayed respect and appreciation for each other's efforts. Finally, the *Chase Charlie Races* reached "effectiveness" by setting good examples of fitness within the community. The Ball State Sport Administration Club not only provided volunteer race management but also demonstrated good examples of successful students actively involved in sport leadership. The most important goal, however, was to set an example of physical activity and health consciousness throughout the county.

Once the *Chase Charlie Races* have been completed and evaluated, those involved in the project have gotten back far more than they have given. The idea of this project is to ensure

the community receives both monetary and service benefits from the project. Universities have valuable resources (ie. students, faculty, facilities, libraries, technology and research expertise) that become available to the community when the project/partnership addresses specific community needs (Bringle & Hatcher, 1996). Community-based organizations that involve college students in service-learning projects identify the following kinds of benefits (Naughton, 2000; Roehlkepartain, 2007): (1) The opportunity to expand their mission and reach without significantly increasing costs by engaging a team of proficient, motivated college students who share their talents and time in support of the organization's mission; (2) The addition of new energy, ideas, and enthusiasm as well as specialized skills that young people can bring to the organization.

What is distinctive about the reflection part of this project is its multi-layered quality: students reflect on the project, not just in greater academic mastery (course content) but also in an expanded appreciation of the contextual/social significance of the project as it relates to the youth in the county and local community. The overriding goal is for students to gain an enhanced sense of civic responsibility as they interact with the community sport leaders and discuss their observations and possible solutions. Student social capital development (e.g., their relationship with adult civic leaders and community organizations) has been demonstrated to be much higher in students who participated in service-learning than those who did not (Henness, 2001). By extending the concepts of the classroom to include youth and schools in the county, it links traditional on-campus learning to experiences in the world beyond the campus. This project seeks to reverse the perception of professors at the university primarily using the community as a research laboratory for the university's own ends.

Conclusion

This research project demonstrated that experiential service learning engages the participants in an active student-driven learning process producing such benefits as integrating theory, research, and practice to skills in the real world, including the critical and analytical thinking involved in putting on an event. The benefits of student club-based service learning

demonstrated within the *Chase Charlie Races* support the continued expansion of this learning modality within sport management. Keep in mind though the benefits outlined above are not automatic or universal. The specific impacts will vary based on focus, scope and quality of the service learning project (Roehlkepartain, 2007). As the opportunities for outside funding and resource development in sport management are typically quite limited, the *Chase Charlie Races* program initiated a revenue stream that proved vital to the development of the experiential service learning co-curricular project. Continued implementation of such events benefits the students, faculty, university, and community.

The initial success of the *Chase Charlie Races* as a service-learning project provides a working model for implementation of similar projects in the future. Although this project was focused upon implementation in a sport management setting, application of these concepts by other academic units with similar goals of positively impacting their community through physical activity, such as physical education, health education, or exercise science, is recommended. However, additional research should be conducted regarding specific assessment of learning objectives, and to explore other direct measures of stakeholder benefits to further demonstrate the value of these types of learning experiences within the curricular or cocurricular setting. The additional research in this type of pedagogical method will provide additional empirical evidence of outcome achievement and will create a more clear assessment of student learning. The benefits for the multiple stakeholders within these experiential learning programs create a value-added product that deserves an expanded part in sport management pedagogy as well as related fields.

References

Ball Brothers Foundation. (n.d.). *Core values*. Retrieved from http://www.ballfdn.org/index/corevalues.asp

Ball State University. (2007). *Strategic plan 2007-2012: Ball State University education redefined*. Retrieved from http://cms.bsu.edu/~/media/0D3AE86AFB364077960B6DCD6A98F372.ashx

Bringle, R., & Hatcher, J. (1996). Implementing service learning in higher education. The Journal of Higher Education *67*(2), l, Retrieved from http://www.compact.org/advancedtoolkit/pdf/bringle-all.pdf

Centers for Disease Control and Prevention. (2006). *Youth risk behavior surveillance – United States, 2006: Surveillance summaries, June 9, 2006*. (Morbidity and Mortality Weekly Report, 55 No. SS-5).

Cuneen, J., & Parks, J. (1997). Should we serve sport management practice or sport management education? A response to Weese's perspective. *Journal of Sport Management, 11*, 125-132.

Cuneen, J., & Parks, J. (2001). Competing interpretations of Stier's and Schneider's (2000) undergraduate sport management curricular standards study. *International Journal of Sport Management, 2*(1), 19–30.

Danylchuk, K. E., & Boucher, R. (2003). The future of sport management as an academic discipline. *International Journal of Sport Management, 4*, 281-300.

Daughtrey, C., Gillentine, A., & Hunt, B. (2002). Student collaboration in community sporting activities. *Journal of American Alliance for Health, Physical Education, Recreation and Dance, 15*, 33-36.

Furco, A. (2002). Is service-learning really better than community service? A study of high school service. In A. Furco & S. H. Billig (Eds.), *Advances in service-learning research: Vol.1. Service-learning: The essence of the pedagogy* (pp. 23–50). Greenwich, CT: Information Age.

Gladden, J. M., & McDonald, M. (1999, June). *Implementing experiential learning: Techniques, challenges and rewards*. Paper presented at the annual North American Society for Sport Management Conference, Vancouver, British Columbia.

Henness, S. A. (2001). K–12 service-learning: *A strategy for rural community renewal and revitalization*. Washington, DC: Corporation for National Service.

Hlebowitsh, P. S., & Wraga, W. G. (Eds.). (1998). *Annual review of research for school leaders*. New York: Macmillan Library Reference USA.

Indiana Quick Facts: US Census Bureau, Delaware County, Indiana. Retrieved from: http://quickfacts.census.gov/qfd/states/18/1851876.html

Judge, L. W., Petersen, J., & Lydum, M. (2009). The best kept secret in sports: The 2010 Youth Olympic Games. *International Review for the Sociology of Sport, 44* (2–3), 173–191.

Krippendorff, K. (1980). *Content analysis: An introduction to its methodology*. Thousand Oaks, CA: Sage Publications.

Meyer, S., Hofschire, L., & Billing, S. H. (2004). The impact of service-learning on student achievement: A statewide study of Michigan Learn and Serve grantees. *RMC Research Corporation*.

Milner, L. M. (1995). Telemarketing for the business school as a sales course project. *Journal of Marketing Education, 17*(3), 73-79.

Mullin, B., Hardy, S., & Sutton, W. (2007). *Sport marketing*. Champaign,

IL: Human Kinetics.

Naughton, S. (2000). *Youth and communities helping each other: Community-based organizations using service-learning as a strategy during out-of-school time*. Washington, DC: Corporation for National Service.

National Association of Secondary School Principals. (1996). *Breaking ranks: Changing an American institution*. Reston, VA: NASSP.

Ogden, C. L., Carroll, M. D., Curtin, L. R., McDowell, M. A., Tabak, C. J., & Flegal, K. M. (2006). Prevalence of overweight and obesity in the United States, 1994-2004. *Journal of the American Medical Association, 295*, 1549-1557.

Overton, R., & Malinauskas, B. (2007). College sport management student perceptions regarding Special Olympics curriculum and service learning. *The Sport Journal, 10*(3). Retrieved from http://www.thesportjournal.org/article/college-sport-management-studentperceptions-regarding-special-olympics-curriculum-and-servi

Parkhouse, B. L. (2001). *The management of sport: Its foundation and application* (3rd ed.). New York: McGraw Hill.

Pauline, G., & Pauline, J. S. (2007). Chase Charlie run, walk, roll. *Indiana AHPERD Journal, 36*(1), 26-28.

Pauline, G., & Pauline, J. S. (2008). Teaching sport sponsorship activation through a client-based experiential learning project. *Sport Management Education Journal, 2*(1), 19-37.

Petersen, J., & Pierce, D. (2009). Professional sport league assessment of sport management curriculum. *Sport Management Education Journal, 3*(1), 107-121.

Pitts, B. G. (2001). Sport management at the millennium: A *defining moment*. *Journal of Sport Management, 15*, 1-9.

Roehlkepartain, E. (2007). Benefits of community based service learning. Retrieved from http://www.servicelearning.org/benefits-community-based-service-learning

Rogers, C. R., & Freiberg, H. J. (1994). *Freedom to learn* (3rd ed.). Columbus, OH: Merrill/MacMillan.

Southall, R. M., Dick, R. J., & VanStone, J. (2008). *Bridging the gap: Design, development, implementation and evaluation of a sport-ticket sales training program* (Paper presented at the annual North American Society for Sport Management Conference), Toronto, ON.

Southall, R. M., Nagel, M. S., LeGrande, D., & Han, P. (2003). Sport management practica: A metadiscrete experiential learning model. *Sport Marketing Quarterly, 12*(1), 27-36.

Sowell, T. (1993). *Inside American education*. New York: The Free Press.

Swanson, S. R., & Gwinner, K. P. (2008). An examination of the undergraduate sport marketing curriculum: Tying together course objectives and assignments. *Sport Management Education Journal, 2*(1), 38-56.

Tritschler, K. (2000). *Barrow and McGee's practical measurement and assessment*. Philadelphia: PA: Lippincott Williams and Wilkins.

Troiano, R. P., & Flegal, K. M. (1998). Overweight children and adolescents: Description, epidemiology, and demographics. *Pediatrics, 101*, 97 –504.

United States Department of Health and Human Service. (2010). *Healthy people 2010*. Retrieved from http://www.healthypeople.gov/document/tableofcontents.htm

Welk, G. J. & Meredith, M.D. (Eds.). (2008). *Fitnessgram/activitygram reference guide*. Dallas, TX: The Cooper Institute. ■

Comparison of eSports and Traditional Sports Consumption Motives

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Abstract

With recognition of the need for studying eSports in this interactive digital communication era, this study explored 14 motivational factors affecting the time spent on eSports gaming. Using a sample of 515 college students and athletic event attendees, we further compared eSports game patterns to their non-eSport or traditional sport involvements (game participation, game attendance, sports viewership, sports readership, sports listenership, Internet usage specific to sports, and purchase of team merchandise). Multiple regression results indicated that competition and skill had a statistically significant impact on the time spent on eSports games while peer pressure had marginal significance. Related to the overall findings, developing tailored messages that drives consumption behaviors of target audiences to specific eSports games will provide a better chance for marketers to fulfill their strategic goals of increased purchasing and larger market shares. Understanding that the interest in competition and skill are critical to eSports gamers may influence marketers to focus on creating games and opportunities for gamers to compete against each other and give tangible rewards to the winner. The use of peer pressure may be another motivational factor for playing. Consequently, those marketing dollars could be spent more on the interactive nature of game design. The subsequent analysis on cross-validation check suggests that the results of the regression analysis could be generalized.

Keywords: Video Games, eSports Playing

Based on the history of eSports (sports video or electronic sports) game playing, eSports may be classified into two eras: the arcade era and the Internet era. During the early arcade era (from the1980's to 1990's), popular eSports games included NBA Jam and Virtua Racing (Electronic sports, 2009). Other eSports games gained their popularity with the evolution of the Internet through local area networks (LAN). The advancement of LAN technology changed the mode of eSports consumption from human-versus-machine to human-versus-human (Griffiths, Davies, & Chappell, 2003). Many popular tournaments have drawn hundreds of participants from various continents. Approximately 800 gamers from 78 countries participated in the 2008 World Cyber Games (WCG) that was held in Cologne, Germany (World Cyber Games, 2009). This emerging sports genre has also been recognized as a good spectator sport. For example, several countries have begun regular televising of eSports games through both regional network channels and national broadcasting companies such as the Ongamenet and MBC Game in South Korea, GIGA Television in Germany, XLEAGUE.TV in the UK, and Game One in France (Electronic sports, 2009).

The growth of the Internet and information technology (IT) has accelerated the popularity of interactive digital communications, and in turn, has boosted eSports consumption. Consequently, multimedia outlets cover more eSports games and potential investors have paid more attention to this market segment as a growing sponsorship opportunity. Global companies such as Samsung and Microsoft have been sponsoring the World Cyber Games at event and team levels. Corporate sponsors have jumped into the online advertising industry because online games have become a common promotional venue in which brands get repeated exposure to an avid target market (Chaney, Lin, & Chaney, 2004).

Electronic sports have, in recent years, become a more popular form of leisure activity for many people. Based on the units sold in 2007, sports video games (including auto racing) comprised more than 22% of the entire video game industry (Entertainment Software Association, 2008). This number rose to 44.7% if 'action' genre was included. Among the list of the top 20 popular video games (based on the units sold in 2007), Madden NFL '08 was the 7th ranked purchase for PlayStation 2 and the 12th ranked purchase for Xbox360.

According to the 2008 Entertainment Software Association (ESA) report, nearly 270 million computers and video game consoles were sold within the US, generating close to $10 billion in 2007, and it is estimated that video games are a $20 billion industry in the US alone (Nagle, 2009). The eSports industry is also booming in other countries like South Korea in that professional gaming teams have corporate sponsors (e.g., Samsung) and tens of thousands of spectators gather and cheer for their favorite teams to win (Nagle). A popular online gaming network such as battle.net has over 12 million active users while the largest online gaming network on consoles, *Xbox Live*, has over 17 million subscribers (Electronic sports, 2009). Although these numbers do not provide precise information in terms of how much of the entire game industry is specifically about eSports, it is clear that this emerging market segment produces billions of dollars and contributes economically to the growth of the sport industry as a whole.

Purpose of Study

This research explored the relatively new phenomenon of eSports gaming by focusing on both motivational and behavioral patterns of eSports consumption to determine whether eSports consumption stands alone as a distinct market or whether it is similar or compliments traditional sports consumption. Using regression analysis, the extent to which motives impact time spent on eSports game playing was examined. Using a correlation technique, comparisons were made between eSports and non-eSports (or traditional sports). These included the seven involvements in traditional sports of game participation, game attendance, sports viewership, sports readership, sports listenership, Internet usage specific to sports, and purchase of team merchandise. In addition, a cross-validation check was performed to increase generalization of the findings in the current study. This study may allow researchers to determine which behaviors motivate the desire to play eSports and subsequently, if similar marketing tactics may be used for both

traditional sports and eSports marketing.

Theoretical Background

General definitions of motives imply that individuals have certain needs and these unfulfilled needs become a driving force for future behaviors. Maslow's (1943) seminal work of need hierarchy theory indicated that there are five hierarchical stages of human needs that act as motivating forces for various behaviors. Those needs include, from low to high, physiological needs, safety needs, love needs, esteem needs, and self-actualization needs. In essence, the lower level of needs must be fulfilled in order to move up to the higher levels of needs. In more recent theories, there are various other types of motives that represent various personal, social, structural, and game-related features giving individuals a chance to gratify unfulfilled needs by engaging in eSports games (Lee, Cianfrone, Byon, & Schoenstedt, 2010).

The uses and gratifications theory can be another theoretical framework that provides explanations for an individual's tendency to engage in eSports games. This audience-centered approach requires that individuals take an active role in selecting and integrating media to fulfill needs such as entertainment, relaxation, diversion, escape, knowledge acquisition, interaction, social acceptance, and self-esteem (Katz, 1987; Rubin, 1994; Zillman & Bryant, 1985).

Factors affecting eSports Consumption

The 2008 Entertainment Software Association report indicated that approximately 65% of American households play computer or video games and over 40% of Americans either have purchased or plan to purchase one or more game(s). Electronic sports consumers also demonstrate unique patterns in their game playing behaviors. It is estimated that approximately 16% of the online gamers play a type of action/sports/strategy/role-play game. Nearly half (49%) of these game players are between 18 and 49 years old, and nearly one third (26%) of them are considered mature players (over age 50). While it is still a male-dominated activity, many females (approximately 40%) play eSports games. The 2008 ESA report further indicated that more than one fifth (22%) of the most frequent game players paid to play online games (this is an increase from 19% in 2007). Other types of wireless devices such as cellular phones or personal digital assistants (PDAs) are becoming more popular platforms on which to game, and thus further accelerating the consumption of eSports (Entertainment Software Association, 2008).

This relatively new sports genre tends to appeal to video gamers' psychological and social drives such as excitement, social interaction, competition, achievement, diversion/escape, knowledge application, identification with sport, and fantasy (Kim & Ross, 2006). More specifically, according to the ESA's 2008 report, nearly 60% of the game users play with or against others. The number of gaming participants has steadily increased as evidenced by a 51% rate in 2006 to 56% in 2007 indicating that online gamers often seek opportunities for social bonding while they play video games. The same report indicated that approximately 38% of American households own at least one video game console. Parents are likely to play video games with their children to have fun, socialize with their children, or to monitor the game content (Entertainment Software Association, 2008; Griffiths, 1993). As well, online eSports games are becoming more popular because they are fun, convenient, unpredictable and/or provide an opportunity for skill mastery (Electronic sports, 2009).

While it is known that playing video games is a psychological and social phenomenon, others have found that specific game features may also draw more individuals to play video games. For example, Wood, Griffiths, Chappell, and Davies (2004) found that video game players consider certain features as more vital when playing such as sound, graphics, background setting, duration of game, rate of play, use of humor, control options, game dynamics, winning/losing features, character development, brand assurance, and multiplayer features. Game formats also seemed to play an important role in that a standalone PC/Mac format was more popular than other types such as game consoles, mobile phones, PC/Mac online/multiplayer, and portable consoles, respectively (Wood et al.). That more males tend to play video games on a frequent basis may be because game content is seen as masculine (Morlock, Yando, & Nigolean, 1984), requires visual and spatial skills (Kiesler, Sproull, & Eccles, 1983), and is driven toward social interaction (Griffiths, 1993).

Relationship between Non-eSports and eSports Consumption

Today, there are constant changes in people's lifestyles and there has been some speculation for this shift in behavior from traditional or non-eSports to eSports gaming. To add some clarification for this research topic, the current study used a correlation technique to create Venn diagrams to illustrate the difference (or overlap) between eSports consumption and seven other types of involvements in traditional sports (i.e., game participation, game attendance, sports viewership, sports readership, sports listenership, Internet usage specific to sports, and purchase of sport merchandise). This research may provide empirical evidence that gives some insights into the market composition of the sports industry when considering non-eSports or traditional consumption and eSports consumption. It is worth noting that this study may allow researchers to determine if any marketing tactics used to successfully market traditional sports could also be applied to eSports. If there is not much overlap between eSports and non-eSports consumption, the results would suggest that eSports is a distinct market compared to traditional sports, which would require a new perspective for a better understanding of consumers in both areas.

Method

Sample and Procedure

Using a convenience sampling method, data was collected from students in sport management related courses (e.g., sport marketing, sport finance, and human resource management) and attendees at athletic events on campuses in three US Division I Mideast universities. This population was deemed appropriate for this type of research because Deerickson's (2005) research reported that while 75% of heads of households play computer or video games, the average game player's age is 30 years old. Not surprisingly, a significant percentage of gamers are teenagers with 35% of gamers under 18 years old. Forty-three percent of gamers are in the 18-49 year old age bracket and 19% are over 50 years

of age.

Prior to distributing the questionnaires, brief instructions were given to the respondents about the purpose of the study and the request for voluntary participation. Institutional review boards approved the instrument at all institutions, and the surveyors took social and behavioral research training prior to data collection. Initially, 587 questionnaires were collected. After excluding incomplete questionnaires, 515 surveys were deemed acceptable. The sample consisted of 82.9% male and 16.1% female participants (1% missing). The majority of respondents were between 16 and 32 years old (M_{age} = 20.02). The ethnic background was 80.8% White, 10.5% Black, 2.3% Asian, 1.7% Hispanic, and 3.3% Other (1.4% missing).

Instruments

The survey instrument was borrowed from Lee, Cheon, Judge, Shin, and Kim's (2010) study and also included the use of existing scales from Kim and Ross (2006) and Sherry, Lucas, Greenberg and Lachlan (2006). Lee, Cheon, et al. added newly developed items representing 14 eSports consumption motives: *Social interaction, Fantasy, Identification with Sport, Diversion, Competition, Entertainment, Sport Knowledge Application, Arousal, Design/Graphics, Pass Time, Control, Skill Building for Playing Actual Sport, Permanence, and Peer Pressure*. To compare eSports consumption with non-eSports, seven items measuring involvements in traditional sports were added: game participation, televised sports viewing, purchase of team merchandise, use of the Internet specific to sport, using print media about sport, listening to the radio specific to sport, and game attendance. In Lee, Cheon, et al.'s study, the scale had Cronbach's alpha ranging from .63 to .87 that used an American sample. In their study, discriminant validity was established in that all factor correlations were equal to or below .71 and met Kline's 2005 criterion. In the current study, the scale was pilot tested prior to the main data collection (refer to *'Pilot Test Results'* section).

Data Analysis

Using the SPSS 18.0 program, descriptive statistics, correlation analysis, and multiple regression analysis were conducted. Multiple regression analysis was used to examine the extent to which the chosen factors influenced the amount of time spent on eSports game playing. For cross-validation purposes, the data set was divided into two random sub-samples. Based on Tabachnick and Fidell's (2001) recommendation, the main data set had 70% (n = 356) of the original data set and the remaining 30% (n = 159) was used as the cross-validation subsample. Predicted scores were created for the cross-validation subsample using the regression equation from the analysis that used the larger sample. Then, predicted scores and actual scores for the subsample were correlated to find *R* squares. According to Tabachnick and Fidell, "a large discrepancy between R2 for the smaller and larger samples indicates overfitting and lack of generalizability of the results of the analysis" (p. 135). To illustrate similarity/difference between eSports and non-eSports, correlation values were used to create Venn diagrams.

Results

Pilot Test Results

Seventy-one university students from business and sport management classes participated in a pilot study. Twenty participants indicated no or very minimal experience in eSports games (who spent no more than half an hour per week) and thus were excluded in the data analysis. Cronbach's alpha for 13 out of 14 factors ranged from .71 to .86. *Control* had alpha value of .57, but the alpha value increased to .70 with only two items. Item-to-total correlation for 13 out of 14 factors ranged from .40 to .81. This value for *Control* factor ranged from .21 to .51. Due to low reliability, the third item in *control* was excluded in the main data analysis.

Psychometric Properties of the Scale

Hair, Anderson, Tatham, and Black (1998) suggested that the variance inflation factor should be less than 10 and tolerance should be greater than .10 to be free from multicollinearity, which was the case in the present study. Cronbach's alpha ranged from .71 to .86 (Table 1-Page 45). Item206 to-total correlations ranged from .40 to .80 (Table 1). Discriminant validity among the factors was established in that all factor correlations were lower than .85 (Kline, 2005; Table 2-Page 45).

Descriptive Statistics and Correlation Analysis

In the main subsample, entertainment had the highest mean of 5.01 while peer pressure had the lowest mean of 3.33. Correlations for the fourteen motives ranged between .06 and .69. Correlations between eSports consumption and seven traditional sports involvements ranged between -.03 (eSportsgame attendance) and .27 (eSportsInternet). Among the seven correlation-values, five were statistically significant. Based on these findings, five Venn diagrams were created (Figure 1) to illustrate overlaps between eSports consumption and the chosen involvements in traditional sports.

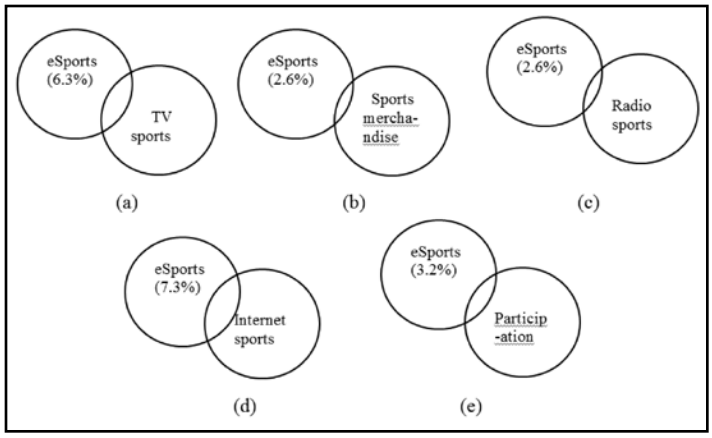

Figure 1. Relationship between eSports and Non-eSports Consumption

Multiple Regression Analysis

Multiple regression analysis revealed a number of significant findings. At the univariate level, *competition* and *skill* had a statistically significant impact (p = .03 and .02, respectively) on the time spent on eSports games while *peer pressure* had marginal

Table 1. ***Means, Standard Deviations, Item-To-Total Correlations, and Cronbach's Alpha***

Items	*M*	*SD*	r^a	α
Entertainment	5.01	1.32		.84
I play sport video games because it is enjoyable			.71	
I play sport video games because it is a fun way to spend my time			.69	
I play sport video games because of their entertainment value			.73	
Knowledge	4.71	1.44		.80
I simulate my strategies at the video game			.40	
I use my knowledge about players and teams while playing the games			.80	
I apply my knowledge to select players and teams			.70	
I use my sport knowledge in general while playing the games		.60		
Control	4.43	1.43		.73
The ability to modify the game set up enhances sport video game playing			.57	
I enjoy the controlling aspect of sport video games			.57	
Identification with sport	4.41	1.48		.73
My favorite sport is a sport the sport video game is modeled on			.57	
I like any video game related to my favorite sport			.63	
To continue to enjoy the sport I like, I also play sport video games			.47	
Design/graphics	4.38	1.44		.78
I enjoy virtual aspects of sport video games with vivid graphics			.64	
I play sport video games because of realistic graphics			.60	
I often play sport video games because of the way they are designed			.64	
Competition	4.33	1.55		.79
I like to play to prove to others that I am the best			.76	
When I lose to someone, I immediately want to play again in an attempt to beat him/her		.48		
It is important to me to be the fastest and most skilled person playing the game			.69	
Permanence	4.32	1.36		.86
I tend to play sport video games because they are readily available			.75	
I tend to play sport video games because I can play them at my convenience			.72	
I often play sport video games because I can play them as long as I want			.77	
To pass time	4.26	1.37		.77
I often play sport video games because there is nothing else to do			.64	
Playing sport video games can be a good way of passing time			.65	
Passing time is my primary goal to play sport video games			.53	
Fantasy	4.22	1.58		.83
Sport video games allow me to pretend to be a sport star or team member			.79	
I like to do something that I could not normally do in real life sport through a sport video game			.62	
I enjoy the excitement of assuming an alter ego in a sport game			.67	
Social interaction	4.19	1.26		.82
Because it provides opportunities to be connected with others			.56	
I will spend time playing sport video games with others			.55	
An important reason for playing sport video games is spending time with others			.81	
I use video games as a reason to get together with others			.70	
Diversion	4.08	1.44		.75
Playing sport video games gives me a break from my regular routine			.57	
Video gaming provides a change of pace from what I regularly do			.62	
I play sport video games instead of other things I should be doing			.57	
Arousal	4.08	1.37		.79
I find that playing sport video games raises my level of adrenaline			.54	
I play sport video games because they excite me			.78	
Sport video games keep me on the edge of my seat			.69	
I play sport video games because they stimulate my emotions			.40	
Skill	3.62	1.48		.86
Playing sport video games helps me learn skills for real games			.78	
I play sport video games to build real game skills			.73	
Playing sport video games can be a good way of learning skills for real games			.72	
Peer pressure	3.33	1.47		.71
Knowing many others playing sport video games makes me play more			.48	
I feel I need to play sport video games because others play			.68	
My friends forces me to play sport video games			.46	

Note. r^a indicates item-to-total correlation.

Table 2. ***Factor Correlations***

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Entertainment (1)	1													
Knowledge (2)	.64	1												
Control (3)	.53	.57	1											
IDSport (4)	.55	.66	.57	1										
DeGraph (5)	.62	.64	.58	.59	1									
Competition (6)	.43	.54	.59	.53	.43	1								
Permanence (7)	.69	.58	.65	.62	.62	.49	1							
To pass time (8)	.44	.39	.44	.38	.44	.32	.56	1						
Fantasy (9)	.34	.38	.53	.44	.39	.48	.47	.38	1					
SocialInter (10)	.41	.40	.42	.43	.46	.42	.51	.35	.31	1				
Diversion (11)	.53	.48	.30	.47	.50	.27	.56	.52	.21	.36	1			
Arousal (12)	.55	.60	.65	.62	.59	.62	.63	.36	.54	.53	.34	1		
Skill (13)	.35	.47	.58	.52	.48	.49	.48	.31	.51	.39	.21	.62	1	
Peer pressure (14)	.22	.26	.51	.39	.34	.43	.44	.34	.54	.48	.06	.58	.59	1

Note. All correlations are significant at the .01 level (2-tailed).

significance (p = .05). All selected factors collectively explained 10.1% of the variance on the dependent measure. Overall, it was found that for every one unit that motive for *competition* increased among eSports gamers, the degree in spending time on eSports games was predicted to increase by approximately .561 units. For every one unit that *peer pressure* increased among eSports gamers, the degree in spending time on eSports games was predicted to increase by approximately .561 units. In contrast, for every one unit that motive for *skill building for actual playing of sport* increased among eSports gamers, the degree in spending time on eSports games was predicted to decrease by .594 units.

Table 3. ***Regression Analysis of the Factors Impacting eSports Game Playing***

Independent Variables	*B*	*t*	*Sig.*
(Constant)			
Social interaction	-.331	-1.177	.24
Knowledge	.091	.280	.77
Fantasy	.228	.965	.33
Competition	.561	2.142	.03*
Entertainment	.010	.032	.97
Diversion	-.180	-.628	.53
Identification with Sport	.374	1.334	.18
Arousal	-.108	-.315	.75
Control	.036	.107	.91
Peer Pressure	.561	1.925	.05*
Skill	-.594	-2.200	.02*
To Pass Time	.282	1.031	.30
Permanence	.006	.016	.98
Design/Graphics	-.032	-.106	.91

Note. indicate significance at the .05 level.
* Indicates marginal significance.

Cross-Validation of Regression Analysis Results

From the regression analysis for the main subsample (n = 356), the following regression equation was obtained: 1.211 + 0.561*Competition + 0.561*Peer Pressure- 0.594*Skill. Using this equation, predicted scores for the smaller subsample were calculated for a cross-validation check. The Pearson correlation between the predicted scores and actual scores of the time spent on eSports games for the smaller subsample was .31 (significant at

the .05 level). Based on Tabachnick & Fidell's (2001) guideline, a small discrepancy between the 9.6% of the squared correlation for the validation subsample and the 10.1% of the main subsample validates generalizability of the findings in the current study.

Table 4. ***Correlation between Predicted and Actual Scores on eSports Consumption***

	Predicted eSports	eSports
Predicted eSports	1.0	
Sports	.31	1.0

Note. Number of observations: predicted = 125, eSports = 131.

Table 5. ***Correlations between eSports and Non-eSports Consumption***

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
eSports (1)	1							
Attendance (2)	-.03	1						
TV (3) .25	.12	1						
Merchandise (4)	.16	.19	.14	1				
Print (5)	.09	.02	.38	.09*	1			
Radio (6)	.16	.07	.18	.13	.27	1		
Internet (7)	.27	.02	.53	.07	.37	.20	1	
Participation (8)	.18	.20	.26	.23	.16	.12	.08	1

Note. All correlations are significant at the .01 level (2-tailed).

Discussion

The overall results of regression analysis show that there is a personal and social element to game playing and that the specific features of a game positively influence an individual's interest in eSports game playing. More specifically, three motives (i.e., *competition, peer pressure*, and *skill building for actual playing of sport*) had a statistically significant impact on the amount of time spent on eSports game playing. Consistent with Kim and Ross' 2006 study, our finding indicates that competition is one of the three impact factors for eSports game playing and indicates that it is important for eSports gamers to be better than others, to win over others, and to be faster and more skilled in their game experience. This finding further implies that the competitiveness of eSports games needs to be continuously cultivated and optimized.

The designers/producers of eSports games may need to utilize the concept of team/institution/player rivalries to accomplish their mission of attracting more players and buyers. Knowing many other people playing eSports games (peer pressure) is likely to encourage individuals to play eSports games. Assuming that eSports game playing was a voluntary action by the participants in this study, it is reasonable to assume that eSports games have become a socially accepted leisure activity. It is critical for marketers to take advantage of this trend and secure market share especially in several other developing global markets like BRICKs (Brazil, Russia, India, China, and South Korea). The findings of this study are consistent with current trends in the video game industry in that the Entertainment Software Association estimated that sales of computer and video game consoles generated approximately $10 billion within the US in 2007. This was a 270% increase in total sales compared to just a decade ago ($3.7 billion in 1997).

While *competitiveness* and *peer pressure* had a positive influence on eSports game playing, skill building for actual playing of sport had a negative influence on the amount of time spent on eSports. No literature exists that allow us to compare this finding. Although use of a convenience sample may limit its generalizability, this type of finding introduces a different perspective in explaining eSports consumption patterns. We first interpret this finding from the measurement perspective. For example, because the items in this factor measured whether playing eSports games helped to build real game skills, this result implied that there is a large discrepancy in the perception of skill building by game playing in a virtual environment versus real game settings. In addition, it is reasonable to say that virtual gaming such as eSports gives individuals a good opportunity to vicariously achieve what they cannot accomplish in a real sports setting (e.g., power fade or draw shots in golf). This finding further suggests that adequate instructions for eSports game buyers should be developed and supplied with the games when sold. Such instructions should also be detailed enough for experienced players but easy enough to follow for new users. Sellers of eSports games may also consider establishing a 'consumer interactive Q&A team' that can readily provide feedback on consumer inquiries.

Inconsistent findings were also revealed in the current study. For example, unlike in the general literature, factors that are related to game features did not have statistically significant impact on the dependent measure in the current study. More specifically, Wood et al., (2004) indicated that game features including graphics (design/graphics in the current study), duration of game (permanence in the current study), and/or control options are important when enjoying video games. However, that was not the case in the current study. Future research will need to focus on explaining this type of behavior among eSports consumers.

Correlation between eSports consumption and the seven traditional sports behavior (non288 eSports) involvements (i.e., game attendance, game participation, sports viewership, sports readership, sports listenership, Internet usage specific to sports, and purchase of team merchandise) indicated the similarities and differences that exist between the very different forms of sport consumptive behaviors. Answering the question as to whether eSports games may be an alternative but similar form of traditional sports or a different consumption behavior among this study population can be seen in the Venn diagrams. The Venn diagrams that were created based on correlation results from this study is evidence of the overlap between eSports consumption and the chosen involvements in five of the seven traditional sports behaviors. Varying portions of the overlap between eSports and non-eSports illustrate that televised sports viewing and Internet usage specific to sport are more related to eSports. Less similarity was found between eSports and three other traditional sports consumption behaviors (i.e., game participation, radio listenership, and team merchandise purchase). Interestingly, there was no significant overlap between eSports and two other involvements in traditional sports (i.e., game attendance and using print media about sports). Because there has been no, if any, attempt to empirically compare eSports with traditionally popular sports consumption behaviors, this type of finding introduces a new perspective in gaining a better understanding of eSports consumption and marketing emphases.

Related to the overall findings, it is essential for marketers to

develop effective marketing strategies for eSports to reach specific target audiences. By developing tailored messages that drives consumption behaviors of target audiences to specific games, there will be a better chance for marketers to fulfill their strategic goals of increased purchasing and larger market shares. For example, understanding that the interest in competition and skill are critical to eSports gamers may influence marketers to focus on creating games and opportunities for gamers to compete against each other and giving tangible rewards to the winner. The use of peer pressure may be another motivational factor for playing and consequently, those marketing dollars should be spent more on the interactive nature of game design. Clearly, from the result of this study, skill building for actual playing of sport inversely motivates eSports gamers and thus would not be a strong impact for behavior at which to target marketing dollars. Lastly, the subsequent analysis on cross-validation of the findings indicated that the results of the regression analysis could be generalized. This type of cross-validation test may make the current study more worthwhile as a result.

Limitations and Future Research

Some limitations and recommendations are acknowledged. Due to low reliability, one control item was excluded in the data analysis. Face/content validity of the item needs to be improved and then used in future studies. The chosen 14 factors only explained a total of 10.1% of the variance on eSports game playing. To implement the cross-validation test, 30% of the entire sample was used. While the sample size (n = 515) satisfies the minimum sample size required, the population size could be increased in further research. Due to the use of a convenience sample, the current findings are limited in their generalizability to all populations. Future research in this area should test the models on larger, independent samples. Opening the study to wider and more diverse demographic groups that would include younger and older players, more girls and women, and additional geographic populations will make the research analysis more robust. Comparing the results of this study to current marketing strategies would also be of interest as this research was clear in the motivations and behaviors of this study population.

References

Chaney, I. M., Lin, K-H. & Chaney, J. (2004). The effect of billboards within the gaming environment. J*ournal of Interactive Advertising, 5*(1), 1-15.

Deerickson. (2005, October 13). Demographics of video gamers [Web log post]. Retrieved from http://e-strategyblog.com/2005/10/demographics-of-video-gamers/

Electronic sports. (November, 2009). Retrieved from http://en.wikipedia.org/wiki/Electronic_sports

Entertainment Software Association (2008). *Essential facts about the computer and video game industry*. Retrieved from www.theesa.com

Griffiths, M. D. (1993). Are computer games bad for children? *The Psychologist: Bulletin of the British Psychological Society, 6*, 401-407.

Griffiths, M. D., Davies, M. N. O., Chappell, D. (2003). Breaking the stereotype: The case of online gaming. *CyberPsychology & Behavior, 6*(1), 81-91.

Hair, J. F., Jr., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate data analysis* (5th Ed.). Upper Saddle River, NJ: Prentice-Hall, Inc.

Katz, E. (1987). Communication research since Lazarsfeld. *Public Opinion Quarterly, 51*, 525351 545.

Kiesler, S., Sproull, L., & Eccles, J. S. (1983). Second class citizens. *Psychology Today, 17*, 41353 48.

Kim, Y., & Ross, S. D. (2006). An exploration of motives in sport video gaming. *International Journal of Sports Marketing & Sponsorship*, (October), 34-46.

Kline, R. B. (2005). *Principles and practice of structural equation modeling*. New York: The Guilford Press.

Lee, D., Cheon, W-K., Judge, L. W., Shin, H-B., & Kim, K-O. (2010). Motives and marketingstimuli affecting eSports consumption: A cross cultural comparison. Manuscript submitted for publication.

Lee, D., Cianfrone, B. A., Byon, K. K., & Schoenstedt, L. (2010). An examination of the relationships among personal values, team identification, product involvement, product attributes, and purchase intention of licensed team merchandise. *International Journal of Sport Management, 11*, 517-540.

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*(4), 370- 396.

Morlock, H., Yando, T., & Nigolean, K. (1984). Motivation of video game players. *Psychological Reports, 57*, 148-156.

Nagle, M. (April 11, 2009). *Video game becomes spectator sport*. The New York Times. Retrieved from http://www.nytimes.com/2009/04/12/sports/othersports/12star.html?_r=1&ref=othersports.

Rubin, A. M. (1994). Media uses and effects: A uses and gratifications perspective. IJ. Bryant & D. Zillmann (Eds.), *Media Effects: Advances in Theory and Research* (pp. 417-436). Hillsdale, NJ: Lawrence Erlbaum Associates.

Sherry, J. L., Lucas, K., Greenberg, B. S., & Lachlan, K. (2006). Video game uses and gratifications as predictors of use and game preference, In P. Vorderer & J. Bryant (Eds), *Playing Video Games:* Motives, responses, and consequences, Nahwah, NJ: Lawrence Erlbaum Associates, Inc.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics*. Needham Heights, MA: Pearson Education Company.

Wood, R. T. A., Griffiths, M. D., Chappell, D., & Davies, M. N. O. (2004). The structural characteristics of video games: A psycho-structural analysis. *CyberPsychology & Behavior, 7*(1), 1-10.

World Cyber Games (November, 2009). Retrieved from http://www.wcg.com.

Zillman, D., & Bryant, J. (1985). *Selective Exposure to Communication*. Hillsdale, NJ: Lawrence Erlbaum Associates. ■

Environmental Health Knowledge, Attitudes and Practices of Students in Grades Four through Eight

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Abstract

The purpose of this study was to investigate environmental health knowledge, attitudes and practices of children enrolled in grades four through eight at a university laboratory school in southeast Louisiana, U.S.A. Quantitative and qualitative questions were completed through an online survey. The children's written responses to the survey questions revealed varying degrees of knowledge, attitudes and practices concerning various environmental health issues. Significant differences were found by students' gender and grade level. The qualitative analyses were consistent with and provided support for the quantitative findings. Suggestions for future research are provided.

Key words: children, conservation practices, recycling, pollution

During the past three decades, concern for the global environment has increasingly attracted the attention of individuals, communities, governments, scientists, conservation groups, industry, and the media. Considerable focus has been directed toward making people and organizations more aware of how their environmental behaviors and practices may create, contribute to, or worsen ecological problems, which in turn may pose a threat to the quality of life on our planet (Gore, 1993; Makki, Abd-El-Khalick & Boujaoude, 2003). Significant action has also been directed toward educating the public so that individuals may become more sensitive to beneficial environmental practices including conserving natural resources and preserving ecologically important natural resource areas (e.g., coastal wetlands) (Sivek, 2002).

Considering the potential long term consequences of environmental abuse on the future quality of life worldwide, it is not surprising that research studies in the past 15 years have focused on the environmental knowledge, attitudes and behaviors of college students (McMillan, 2003; Thapa, 1999). Other studies have focused on these issues with school-age children (Blanchet-Cohen, 2008; Bonnett & Williams, 1998; Kuhlemeier, van den Bergh & Lagerweij, 1999; Lo, 2010; Loughland, Reid, Walker, & Petocz, 2003; Makki et al., 2003; Palmer & Suggate, 1996; Said, Yahaya & Ahmadun, 2007; Sivek, 2002; Tuncer, Ertepinar, Tekkaya & Sungar, 2005; Van Petegem & Blieck, 2006; Witt & Kimple, 2008). Such investigations are critical since children and youth will be most significantly impacted by today's environmental practices and behaviors.

Interest in research dealing with environmental knowledge, attitudes and practices of children and youth is evidenced by the number and diversity of countries that have been the primary residences of subjects who participated in these studies. These countries included Australia (Loughland et al., 2003), Belgium and Zimbabwe (Van Petegem & Blieck, 2006), Canada (McMilian, 2003; Blanchet-Cohen, 2008); China (Lo, 2010), Lebanon (Makki et al., 2003), Malaysia (Said et al., 2007), Netherlands (Kuhlemeier et al., 1999), Nigeria (Ebong, 1994), Norway (Sorgaard & Lyngstad, 1994), Turkey (Tuncer et al., 2005), United Kingdom (Bonnett & Williams, 1998; Palmer & Suggate, 1996) and the United States of America (Gambro & Switzky, 1999; Sivek, 2002; Thapa, 1999; Witt & Kimple, 2008). These studies reported findings from interviews and/or surveys of male and female students enrolled in a variety of public and private institutions, with most subjects enrolled in secondary schools or colleges and universities. The number of completed published investigations focusing on environmental knowledge, attitudes and behaviors of elementary school children is limited (Blanchet-Cohen, 2008; Lo, 2010; Loughland et al., 2003; Tuncer et al., 2005; Sorgaard & Lyngstad, 1994; Witt & Kimple, 2008).

Typically, subjects in past research were required to respond to rating scales. These consisted of closed-ended statements or questions related to the environment that were later analyzed quantitatively, or students responded to open-ended statements which were analyzed qualitatively. Few studies exist which combine quantitative and qualitative analyses of both closed-ended and open-ended written responses of elementary school children dealing with their environmental knowledge, attitudes and practices.

This investigation was designed to address some of the limitations of past research. It examined the environmental health knowledge, attitudes and practices of children enrolled in grades four through eight at a southeast Louisiana university laboratory school, a public school located on campus. Both closed and open-ended questions related to a diverse range of global environmental topics.

Methods

The study was reviewed and approved by the University's Institutional Review Board. Parental consent forms were required for student participation. Prior to the administration of the survey, each student completed an assent form, agreeing to participate in the study.

Students completed the online survey in the school's computer lab during their regularly scheduled computer time. As part of the administration protocol, students were informed of the purpose of the study, were allowed to ask questions and were instructed as to how they could exit the survey at any time. Students were reminded to read each question carefully and to raise their hands if they had questions. Then, students independently completed both the quantitative and qualitative questions. The length of time for survey completion ranged from 10-15 minutes, with fourth graders requiring more time than older students.

Instrument Development

In the year prior to the full study, researchers conducted focus groups with 24 eighth graders. These students were selected for the focus groups since they were expected to graduate from the

laboratory school and therefore would not be among the group surveyed in the following year. Based on readings of current literature, the researchers developed seven qualitative questions about the environment. Examples included: "Can the environment affect our health? If so, how?"; "What concerns you about the environment?" and "What do you think about when you hear the words, *environmental health*?"

The researchers compiled the responses to the seven qualitative questions, studied these comments, and constructed a draft version of the online survey using the web-based survey builder, SurveyMonkey.com. Pilot tests were performed with fourth graders in the University's Summer Camp Program to determine readability, comprehension and completion time. Revisions were made to the survey based on students' comments. Fourth and fifth grade teachers in local public schools also provided suggestions for changes and additions. A final instrument was constructed incorporating their recommendations.

Using a mixed methods research design, the current study considered both quantitative and qualitative responses. Both study aspects were given the same priority and weight in both the data collection phase as well as the analysis phase. Quantitative questions solicited demographic information as well as knowledge, attitudes and practices concerning the environment. The questions about environmental practices were related to behaviors at school, in the home and in the community. Students were also given the opportunity to type in answers to three qualitative questions concerning the environment. See Table 1 for examples of closed and open-ended questions.

Table 1. ***Sample Survey Questions***

Knowledge questions			
Littering is against the law.	yes	no	I don't know
Pollution damages the earth and the air around it .	yes	no	I don't know
Mold in the environment can make a person sick.	yes	no	I don't know
Behavior/attitude questions			
If I see paper or wrappers on the ground at school, I put them in the trash can.	yes	no	sometimes
I litter.	yes	no	sometimes
I turn off the lights when I leave a room.	yes	no	sometimes
Open-ended questions			
What worries you about the environment?			
What can you do to help or protect the environment?			

Statistical Analyses

Quantitative analyses were conducted using SPSS version 16. Frequency counts and percentages of student responses were compiled and analyzed across gender and grade level groupings. Chi-square statistics were conducted to determine if there were significant differences by gender in selected individual questions assessing knowledge, attitudes and practices. In addition, responses of students in grades 4, 5 and 6 (elementary school) were compared to students in grades 7 and 8 (junior high school).

Qualitative analyses were conducted in an attempt to capture the essence of the open-ended responses and analyzed through the use of coding. The process of coding began with organizing all of the students' responses by placing them into a database. From there, researchers collectively observed the students' responses for each question. Through the process of observing, the researchers discovered patterns of regularities in the data, and in turn, identified and labeled text segments. For example, many respondents indicated "littering" to be something that worries them about the environment. A text segment was defined whenever a word or phrase was used related to littering, such as "throwing trash." Through the process of identifying and labeling the text segments, the researchers were able to examine the data for "overlap and redundancy" (Creswell, 2005, p. 589). In turn, this enabled researchers to collapse the text segments into themes. Themes were developed for each of the survey questions relating to the respondents' concerns about the environment, what makes them happy about the environment, and what they can do to help or protect the environment.

Trustworthiness of the Study

In an effort to ensure the accuracy of the qualitative analyses, the researchers validated the findings through the process of triangulation of data sources. "Triangulation is the process of corroborating evidence from different individuals, types of data, or methods of data collection in descriptions and themes in qualitative research" (Creswell, 2005, p. 252). Through the process of triangulation, the researcher considers the coalescence of three essential data sources. In this study, the process was accomplished through (1) the survey responses themselves, (2) the researchers' notes, and (3) the corroboration of quantitative and qualitative findings. It should also be noted that two researchers examined the qualitative data separately and found the same results.

Participants

Over 100 students participated in the study with a response rate of 92%. Over half of the participants were male and two-thirds were white. Note demographics in Table 2.

Table 2. ***Demographic Information***

Demographic Information	**N**	**%**
All grades	115	92
Gender		
Females	53	45
Males	62	55
Race/Ethnicity		
Black/African American	20.0	17.4
White	79	68.7
Multiracial	4	3.5
Hispanic	4	3.5
Asian	4	3.5
Other	4	3.5
Grade Level		
Fourth	19	16.5
Fifth	25	21.7
Sixth	24	20.9
Seventh	24	20.9
Eighth	23	20

Quantitative Results

Knowledge of and Practices Related to the Environment and Recycling

Students were asked their perceptions of what is considered their environment. Forty-three percent of the students (n = 49) thought that school was part of their environment; 68% (n = 78) had discussed the environment in their classes. Most students indicated that certain environmental conditions could impact health. See Table 3.

Table 3. ***Impact of the Environment on Health***

	Yes	No	I don't know
The environment can make me sick.	58.3% (67)	13.9% (16)	27.8% (32)
Cigarette smoke in the environment can make people sick.	93% (107)	2.6% (3)	4.3% (5)
Mold in the environment can make a person sick.	77.4% (89)	2.6% (3)	20% (23)

About one third of the students (36%, n = 41) said the school recycled and that they had visited a recycling center to drop off items. Twenty-two percent (n = 25) indicated that their families recycled. The top three items recycled by their families were newspapers (52%), cans (45%) and plastics and other paper (38%). Items that were less likely to be recycled were chemicals, paint, computers, light bulbs and oil.

Conservation and Littering

Almost all students (97%, n = 111) indicated that they believed people could hurt the environment by their behaviors and practices. In addition, students reported participating in conservation practices as summarized in Table 4. Seventy-nine percent of the students (n = 91) normally showered but only 12% (n = 14) reported turning the shower on and off to conserve water. Of the 21% (n = 24) that took baths, 71% (n = 17) stated that they did not fill the tub to the top. Further, 70% (n = 81) turned the water off while brushing their teeth.

Table 4. ***Conservation Practices***

Which do you turn off at night?	%	n
Computers	50%	57
Games	72%	83
Television	72%	83
Lights	90%	104

While 74% of the students (n = 85) knew that it is against the law to litter and 97% (n = 111) expressed that they liked to keep their environment clean, 31% (n = 36) still stated that they littered sometimes. However, 37% (n = 43) of the students reported picking up paper or wrappers at school and putting them in the trash can and 34% (n = 39) had told friends not to litter. With regard to littering behaviors in the community, a majority of the students (78%, n = 90) did not litter waterways, throw litter out of the car (62%, n = 71) or drop litter on the ground while attending parades and festivals (80%, n = 92).

Concerns About and Ways to Improve the Environment

Most of the students (88%, n = 101) said they did think about the environment. They were more likely to reflect about the air, trees, rivers and nature and less likely to think about hurricanes, germs and chemicals in the environment. Almost all students (97%, n = 112) stated that they liked to be outside and to breathe fresh air (99%, n = 114).

Slightly over half of the students (52%, n = 60) expressed concern about global warming. Fifty percent (n = 57) knew that Louisiana loses land along its coastline every year. Almost all students (90%, n = 104) agreed that pollution damages the earth and the air around it. Students indicated a number of ways to help the environment as noted in Table 5.

Table 5. ***Ways to Help the Environment***

	%	n
Picking up trash	94%	108
Planting trees	89%	102
Smoke free restaurants	76%	87
Sun/wind power	76%	87
Hybrid cars	53%	61
Stop use of pesticides	52%	60
Compost piles	44%	50

Differences by Grade Level and Gender

Significant differences were found in knowledge between junior high school and elementary school students. While junior high school students exhibited more knowledge of the environment, elementary school students were more likely to engage in healthful environmental practices as shown in Table 6. Chi-square analyses also revealed significant differences by gender as presented in Table 7.

Table 6. ***Differences in Knowledge and Practices by Grade Level***

	Elementary	Junior High	X2	df	P value
Knowledge					
Mold can make you sick.	68%	92%	9.3	2	.009
People can hurt the environment.	100%	92%	6.0	1	.026
Every year, Louisiana loses land along its coastline.	40%	65%	7.2	2	.028
Practices					
Pick up litter	47%	23%	10.5	2	.005
Turn water off when brushing teeth	78%	60%	4.5	1	.028
Don't litter waterways	88%	65%	10.9	2	.004
Tell friends not to litter	44%	20%	7.6	2	.021

Table 7. ***Differences in Knowledge and Practices by Gender***

	Females	Males	X2	df	P value
Knowledge					
Every year, Louisiana loses land along its coastline.	61%	38%	6.7	2	.028
Practices					
Turn water off when brushing teeth	81%	61%	5.4	1	.028
Don't litter waterways	4%	23%	8.7	2	.004

Qualitative Results

Overall Themes

Qualitative results evolved from three open-ended questions that were asked in the survey questionnaire: "What worries you about the environment?"; "What makes you happy about the environment?" and "What can you do to help (or protect) the environment?" The process of coding was used to collapse the students' responses into six themes and ten sub-themes, using their actual phrases. The following is a presentation of themes for each of the three questions set forth by the researchers.

What makes me worry about the environment? When the students were asked to reflect on what "worries" them about the environment, two themes and three sub-themes emerged. The first theme, "Pollution" reflected the concern of littering and was a common response among the students who completed the questionnaire. Through this sentiment, it was seen that the students were concerned about the amount of trash on the ground and frustrated by seeing people litter and/or not picking up trash off of the ground. A sub-theme that emerged from this theme was that of "people who smoke." Many students indicated their dismay over people who smoke and recognized that throwing cigarette butts on the ground or throwing them out of a car window is littering. A second sub-theme of "Pollution" was "we could hurt the animals." This emerged as the students recognized that dirty air and water can adversely affect the health of animals. This was seen through common quotations of "animals can die," "people litter in rivers," "making animals endangered," and "things we dispose of will harm or kill animals."

"Global warming" was a second emerging theme that expressed the students' concerns over the threat of global warming. From this, a sub-theme of "what will the world be like when I grow up?" emerged as many of the students saw global warming as a threat to the future. This was seen through many quotations such as, "I'm afraid for the next generation of kids," "global warming worries me," "my little brother will not have a good world to live [in]," and "what worries me the most is global warming."

When the students reflected on the aspects that worry them about the environment, girls were seen to express stronger concerns pertaining to littering, harm to animals, and smoking than their male counterparts. Junior high school girls, in particular, indicated concerns of water-related issues such as pollution and shortages, and individuals' lack of concern about the environment. More elementary school males expressed alarm about global warming than did females.

What makes me happy about the environment? When students were asked about what made them happy about the environment, students indicated three themes that brought contentment : "Things in nature," "No pollution," and "Recreation." Under the theme of "Things in nature," two sub-themes of "the trees and flowers" and "the animals" emerged. Common quotations that represented the essence of this theme and sub-themes were "the animals that help get us food [products]," "when the birds and other animals have a place to stay without having to worry about their houses being destroyed," and "the beautiful flowers and trees." Interestingly, almost three times as many junior high school females as males indicated that nature, especially trees and plants, gave them pleasure. Also, the theme of "No pollution" represented how pleased the students were with a clean environment. The sub-theme of "seeing people recycle," emerged under this theme and expressed how important the students regarded recycling.

Students also mentioned that outdoor environments for activity and play were important to their happiness. This contributed to the emergence of the third theme of "Recreation" and sub-theme of "a place where I can play." Common quotations that represented this theme/sub-theme included, "I like to go mountain hiking, swimming, canoeing, camping, biking," "having lots of time to play," and "going someplace where it's just you and nature – like some mountains."

Males and females at the elementary school level expressed the need to help the environment, such as reducing the amount of trash and litter. However junior high school males provided scant responses when reflecting on what makes them happy about the environment. While reducing trash and litter was seemingly important to elementary school students, most junior high school males did not share the same concern.

What can I do to help the environment? One major theme emerged from the third open-ended question that allowed students to suggest ways to help the environment. The theme "Stop Pollution" surfaced with three sub-themes of "I can pick up trash," "recycle more," and "stop the cigarettes!" When students reflected on ways they could help, the general consensus among them was that of stopping pollution. This was seen in various forms, ranging from picking up trash to conserving energy. Sample quotations that captured the essence of this theme were, "pick up stray trash you see…recycle, and use hybrid cars," "you can conserve energy, use renewable energy sources when possible, recycle, and keep your community free from littering," "stop littering…[don't use] diesel cars, and stop using pesticides!" and "…turn the water off when you're not using it."

"Stop the cigarettes!" was a sub-theme that developed under the umbrella of "Stop Pollution"; these students viewed smoking as a form of pollution. Quotations that illustrate this include, "…just don't smoke," and "If things are happening now [such as] smoking…the earth will turn into probably a very unpleasant place to be." Of important note, all students, except junior high school males, mentioned that eliminating smoking would promote a healthier environment.

In addition, some students expressed ideas concerning advocacy and conservation of resources. Females in both the elementary and junior high schools were more likely than males to support advocacy in solving environmental issues. Moreover, about one in ten students expressed the need to conserve resources through means such as carpooling, and turning off lights and appliances.

Discussion and Implications

In the current study, the children's written responses to closed-ended questions revealed varying degrees of knowledge, attitudes and practices concerning environmental health issues. For example, about 60% of the students indicated through quantitative responses that the environment could have a negative impact on health and acknowledged the effects of mold and second-hand smoke on individuals' health. Only about half of the students in our study were aware of global warming. Since the university laboratory school is located in southeastern Louisiana, students

were cognizant of environmental issues paramount in this area, such as pollution, hurricanes and coastal erosion. However, this study was conducted before the Gulf of Mexico Oil Spill on April 20, 2010. Since this oil spill, students in this school as well as others in Louisiana may have become more aware of how the petroleum and chemical industries can impact the environment affecting the ecology, health, culture and economics of a region. Thus, the same study repeated might produce different results.

This study supports other research that reported differences in knowledge, attitudes and practices by students' grade levels. In studying 69 Norwegian children and adolescents, ages 8 and 14, Sorgaard and Lyngstad (1994) found more abstract thinking among older students, characterized by a greater awareness of the connection among environmental issues, consumerism and industrial greed. In the quantitative aspect of the current study, more junior high school students than elementary school students were aware of the threat of coastal erosion in Louisiana and the impact of mold on health. Older students may have learned more about these environmental topics in their science or health education classes. However, elementary school students were more likely than male junior high school students to engage in positive environmental practices, like using less water when brushing their teeth and not littering. Similarly, Loughland et al. (2003) noted that primary students were more inclined to show respect and care for the environment than did high school students.

Other investigations have found differences in knowledge, attitudes and practices by gender. Loughland et al. (2003) revealed that females, ages 9-17, were 1.5 times more likely to have a "relation" conception in which they perceived that "the environment contributes to their well being as they contribute to the environment's well being"; they were more likely to care for the environment than males of the same age. Tuncer et al. (2005) conducted a study of Turkish students in sixth, seventh, eighth and tenth grades (mean age=13.5) concerning environmental problems, solutions and individual responsibilities. They found that females exhibited more positive attitudes toward the environment and were more aware of individual responsibilities and overall environmental problems than did boys. Quantitative findings in our study revealed that males were more cognizant of coastal erosion and global warming issues than females. Moreover, it was found that more elementary school males than females were alarmed by global warming. However, females were more likely than males to exhibit positive environmental behaviors such as conserving water, for example, while brushing their teeth. Qualitative themes in our study supported these findings. For example, females as compared to males exhibited more favorable attitudes toward the environment and derived greater pleasure from things in nature, such as trees. Females in our study also were found to be more cognizant of environmental issues and supportive of environmental advocacy than their male counterparts.

Makki et al. (2003) found that a parent's level of education affected students' knowledge and comprehension of the environment. Although this present investigation did not directly address this, we did ask questions regarding recycling practices at home. While our students had knowledge of recycling, less than a quarter of them recycled with their families on a regular basis. However, the theme of "Stop Pollution" was observed in the study where students expressed a strong belief in the need to recycle. Providing lessons in environmental education could increase recycling efforts by families, schools and communities, while promoting conservation of resources.

Bonnett and Williams (1998) suggested that environmental education should be an integral part of the curriculum, allowing students to have the opportunity to express their views and to apply information learned. Witt and Kimple (2008) found that an ideal time to teach lessons about the environment is in preschool. When students learn information at this time, it may remain with them through their school days and into adulthood. However, students in all grade levels should be formally educated about the environment and its impact on health (Lo, 2010). Blanchet-Cohen (2008) stressed the importance of students having direct contact with nature and the need for adult mentoring. In another study by Lo (2010), students engaged in nature experiences in order to develop an appreciation for the environment. In the current study, although students expressed some environmental health knowledge and exhibited positive practices, participation in more formal environmental education lessons could be beneficial. Through this education, students could discuss the impact of the environment on health and engage in interactive activities such as recycling and clean up days. Parents could participate in interactive lessons through school newsletters and special program nights, offering opportunities for collaboration with their children.

The current study through the use of a mixed-design method provided insight into the environmental health knowledge, attitudes and practices of elementary and junior high school students at a university laboratory school. Additional research could focus on assisting classroom teachers in integrating environmental education into their daily lessons and measuring learner outcomes. Also, it may be interesting to follow students from preschool to college to determine which factors predict positive environmental practices. In light of recent global environmental issues, including the Gulf Oil Spill, continued research and education are critical in promoting knowledge about sustainability practices among youth and instilling in them respect for the earth and its environment.

References

Blanchet-Cohen, N. (2008). Taking a stance: Child agency across the dimensions of early adolescents' involvement. *Environmental Education Research, 14*(3), 257-272.

Bonnett, M., & J. William, J. (1998). Environmental education and primary children's attitudes toward nature and the environment. *Cambridge Journal of Education, 28* (20), 159-174.

Cresswell, J. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (2nd Edition). Upper Saddle River, NJ: Pearson Education.

Ebong, R. D. (1994). Environmental health knowledge and practice survey among secondary schoolchildren in Zaria, Nigeria. *Environmental Health Perspectives, 102* (3), 310-312.

Gambro, J. S., & Switzky, A. N. (1999). Variables associated with American high school students' knowledge of environmental issues related to energy and pollution. *Journal of Environmental Education, 30* (2), 15-22.

Gore, A. (1993). *Earth in the balance: Ecology and the human spirit*. Boston: Houghton-Mifflin.

Kuhlemeier, H., van den Bergh, H., & Lagerweij, N. (1999). Environmental knowledge, attitudes, and behavior in Dutch secondary education. *Journal of Environmental Education, 30* (20), 4-14.

Lo, E. (2010). Environmental education in Hong Kong kindergartens:

What happened to the blue sky? *Early Child Development and Care, 180*(5), 571-583.

Loughland, T., Reid, A., Walker, K., & Petocz, P. (2003). Factors influencing young people's conceptions of environment. *Environmental Education Research, 9* (1), 3-20.

Makki, M. H., Abd-El-Khalick, F., & Boujaoude, S. (2003). Lebanese secondary school students' environmental knowledge and attitudes. *Environmental Education Research, 9* (1), 21-33.

McMilian, E. (2003). A method of evaluating the impact of an introductory environmental studies class on the values of students. *Applied Environmental Education and Communication, 2*, 91-98.

Palmer, J. A., & Suggate, J. (1996). Environmental cognition: Early ideas and misconceptions at the ages of four and six. *Environmental Education Research, 2* (3), 301-330.

Said, A. M., Yahaya, N., & Ahmadun, F. (2007). Environmental comprehension and participation of Malaysian secondary school students. *Environmental Education Research, 13* (1), 17-31.

Sivek, D. J. (2002). Environmental sensitivity among Wisconsin high school students. *Environmental Education Research, 8* (2), 155-170.

Sorgaard, K. W., & Lyngstad, A. M. (1994). Interviews with children and young people about nature, environment, and the future. *Arctic Medical Research 53* (1), 12-19.

Thapa, B. (1999). Environmentalism: The relation of environmental attitudes and environmentally responsible behaviors among undergraduate students. *Bulletin of Science, Technology and Society, 19* (5), 426-438.

Tuncer, G., Ertepinar, H., Tekkaya, C., & Sungar, S. (2005). Environmental attitudes of young people in Turkey: Effects of school type and gender. *Environmental Education Research, 11* (2), 215-233.

Van Petegem, P., & Blieck, A. (2006). The environmental worldview of children: A cross–cultural perspective. *Environmental Education Research, 12* (5), 625- 635.

Witt, S.D. & Kimple, K.P. (2008). "How does your garden grow?' Teaching preschool children about the environment. *Early Child Development and Care*, 178(1), 41-48. ■

Attitudes of Terminally Ill Patients toward Death and Dying in Nigeria

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Abstract

The purpose of this study was to analyze the attitudes of terminally ill patients toward death and dying. Four hospitals in Nigeria were randomly selected: University College Hospital, Ibadan; University of Benin Teaching Hospital, Benin City; the Lagos University Teaching Hospital, Lagos; and Igbinedion Specialist Hospital, Okada, Benin City. Sixty, terminally ill patients participated in a structured interview within a descriptive design. Chi-square frequency analysis indicated that the attitudes of the terminally ill toward death and dying were significantly negative.

Death is an issue all humans must face. All human beings can testify that there is birth, that humans progress through various developmental stages of maturity, and that the stages of life end at death. However, there is nobody that can say at what point they came into being and at what point they were deceased. As life moves on, humans live in hopes of seeing the next day. When life ends, it is celebrated in most societies. Death is normally marked by an atmosphere of sorrow by immediate family members and loved ones. However, when the deceased is an older person, there is often some sort of joy and ceremony, the type of which depends on that person's culture and tradition. In celebrating the life of the deceased, the following play a prominent role: religion, culture, money available, and the contribution to the society or community in which they belong

In medieval times, people in the Western World approached death in a more natural way than in present day. Technology has separated westerners from the fundamentals of their biological existence, which has resulted in the realities of death being obscured (Foos—Graber 1989). Reliantly, people think about death and fear it more today with the emergence of HIV/AIDS. However, many people witness death through the television only, as many have no real experience dealing with the death of close relatives or loved ones. So, when it happens people just do not know how to deal with it.

Kubler — Ross (1969) described five stages of grief. These five stages have been very useful to understand people's reactions to grief in general, and dying in particular. They are: *denial, anger, bargaining, depression,* and *acceptance*. She explained that these are normal reactions we have to tragic events. These stages have also been referred to as a defense mechanism or coping mechanism when applied to dealing with traumatic change. Humans do not move through the stages one at a time, in a neat, linear, step-by-step manner. People merely occupy different stages at different times and can even move back to stages they have been in before. The stages can last for different periods of time and will replace each other or exist at times concurrently. Ideally it would be nice to think that humans could all reach the stage of acceptance, which enables persons to cope with tragedy.

Despite the fact that the phenomenon of death is inevitable and is a common occurrence within any society, it is human nature that nobody wants to die. In Nigeria, death and dying are not issues commonly talked about in families, probably because of the fear and mystery surrounding it (Olokor, 1998). Many people do not experience the death of a loved one until middle age and many people die away from the home (e.g. hospices or hospitals) and therefore it is not part of the everyday life of family and friends. People previously always died at home so there was a lot of acceptance of death and you saw death. Although philosophical in nature, the practical concept of death and dying can fall within the realm of health education, in which intellectual, psychological, and social dimensions relate to activities that increase the ability of people to make informed decisions about their personal, family, and community well-being (Ross & Mico, 1980).

Today's terminally-ill patient is progressively losing the privilege of dying in familiar surroundings — surrounded by family, with the patient as the center of interest, and in control of their environment (Olokor, 1998). Furthermore, the prolongation and termination of life is receiving attention by health educators, scientists, social scientists, legal scholars, mass media practitioners, policy makers, and the informed public. Some of these interests naturally stem from the fact that dying is a common human experience. Interest intensifies with age, as people begin to perceive themselves in a *race against time*. Individuals charged with the care of terminal patients, and those engaged in the development of social policies on health at local and national levels, are faced with many issues, such as funding, facilities, medications, and life-support mechanisms.

It is the attitudes of a society that greatly influence the attitudes of the terminally ill toward impending death (Olokor, 1998), and it is the culture of a people that greatly determines their attitudes toward death and dying. Typically, the terminally ill hold a personal hope of overcoming their diseased state, and personal efforts are made to maintain life (e.g., strictly following all instructions given by doctors, taking medication). The attitude of registered nurses (RNs) toward death and dying patients may influence the care they are able to provide (Rooda, Clement & Jordon 1999). The implementation of an educational program tailored to oncology nurses' needs may be useful in helping to foster more positive attitudes toward death and dying patients, therefore providing quality end-of-life (EOL) care. Lange, Thom, and Kline (2008) opined that less experienced oncology nurses will most likely benefit from increased education, training and exposure to effectively handle end-of-life care.

Feudtner et al. (2007) reported that nurses with more years of nursing practice, more hours of palliative care education, and higher levels of hope were more comfortable providing care to dying children and their families, had less difficulty talking about death and dying and showed increased levels of palliative care competency.

However, the culture, values, customs, and socio-cultural

experiences of a person can influence one's attitude toward death and dying, positively or negatively. Ipsos Mori (2010) observed that Asian Muslims did not think that their relatives would be reluctant to discuss death and dying, but there was a feeling that it needed to be relevant at the time, such as when someone was older or ill. The younger participants felt that discussing death and dying was not relevant to them but that they would be happy to discuss it with other relatives who were older. Younger people also said that they did not want to discuss death and dying with family members who they perceived as being closer to death because they felt the subject would be uncomfortable. They further stated that overall culture was seen to have a strong influence on whether or not people discussed death and dying. All felt that death had become something that was not discussed and that this contributed to death becoming a topic that was hidden. This indicated a need to encourage a more open dialogue, generally across society to increase people's familiarity with the issues involved, which may break down some fear of the "unknown". The purpose of this study, therefore, was to examine the attitudes of the terminally ill toward death and dying in Nigeria.

Methods

Participants

Participants in this study were 60 terminally-ill patients. The study focused on the terminal diseases of cancer, acquired immune-deficiency syndrome (AIDS), renal failure, and liver disease. The terminally-ill patients were warded at Lagos University Teaching Hospital (LUTH); University College Hospital, Ibadan (UCH); University of Benin Teaching Hospital (UBTH); and Igbinedion Hospital and Medical Research Center, Okada. The sampling technique used was the purposive sampling technique (sample of convenience). All admitted terminally-ill patients at the time of this study were used.

Instruments

The research instrument for this study consisted of a structured interview schedule. Structured interviews, if properly constructed, have been found to be adequate for studies similar to the present study, and allow for deliberate and careful operationalization (Babbie, 1975). The researcher, following an extensive review of related literature on beliefs and attitudes of terminally ill patients toward death and dying, formulated a 24-item interview protocol. The questions determined demographic information (e.g., age, sex, marital status, ethnic group, religion, social-economic status, level of education, and cultural background; (Section A) and attitudes and beliefs of the terminally ill patients toward death and dying (Section B). A reliability coefficient of .91 was obtained using the split-half test method. Interviews were recorded with a cassette recorder. The respondents were interviewed in the hospital wards in which they were admitted.

Data Analysis

Responses from the interviews formed the basis for coding. Results of the findings collected from the structured interviews were grouped under the variables being investigated. The data were computed and analyzed with the use of a statistical package for social science (SPSS). The analysis shows the demographical characteristics of the respondents and statistical procedure. Frequency analysis was used to describe some aspects of the study, while Chi-square analysis (χ^2) was used for categorical data when testing hypotheses (Kerlinger, 1976).

The data for the demographic questions of section A of the structured interviews were descriptively analyzed. Section B of the interview involved questions/answers with various point scales that can be seen in the Appendix. The range was as follows: Four questions were stratified into strongly agreed, agreed, disagreed, and strongly disagreed, based on the composition of scores of the individuals' responses. The questions were close-ended statements and the respondents were required to examine each of the statements and then indicate their opinion on a 4-point scale. The scores for positive statements were interpreted as follows: 4 for strongly agreed, 3 for agreed, 2 for disagreed, 1 for strongly disagreed. The scores for negative statements were interpreted in the reverse order. To classify individuals into strongly agreed, agreed, disagreed, and strongly disagreed, the number of statements in the variable divided the sum of these weighted statements per variable. Four other questions had four alternatives. Each of the alternatives was scored 1-4 points depending on the order or level of weight. Three questions had three alternatives. The scores were 1-3 points depending on the weight assigned to the alternatives. Finally there were 13 questions that had two alternatives (yes or no). A level of significance of 0.05 was used to test the hypotheses. However, not all participants answered all of the questions.

Results and Discussion

Survey items and response frequencies for attitudes and feelings, beliefs, and attitudes toward medical care can be seen in the Appendix.

Attitudes and Feelings

Of the limited research conducted on attitudes of death, Kalish (1981) contended that the attitude regarding death that has received the most attention was the fear of death, which has consequences on attitude.ÄThe distribution of responses indicated that 88.3% of respondents felt sad on knowing that they were terminally ill and had negative feelings upon being diagnosed as terminal. In addition, the respondents indicated they were not adequately prepared (75%), had not attained all that they wanted in life (81.6%), and did not want to die in spite of being at the terminal stage of their illness (75%). In fact, when asked if the terminally ill would find dying easier if they thought they had a fulfilled life, a strong majority indicated that it would not make dying easier, that death comes too soon; and the majority disagreed that death was a blessing. Many expressed the hope that they would have more time to educate their children and acquire more material wealth for their children. Most of them lamented their inability to play their parental roles, which led to feelings of sadness.

The majority indicated that death was not seen as tragic for the dead, but rather for the survivors. These results suggested that although they are terminally ill and death is eminent, they believe that death should take some time before it comes instead of happening suddenly. As a result, the majority of terminally ill

patients noted a change in their personality since they became ill. In addition, the majority indicated that there had been changes in attitude of family/friends toward them.

Finally, when asked about their family life, the majority of respondents did not agree that their lifestyle was a contributory factor to their terminal illness. Of those who indicated that their lifestyle contributed to their illness (31.7%), a common example was smokers who developed lung cancer.

Beliefs

Many participants indicated that their faith in God was strengthened by their illness because they believed with stronger faith, that a miracle could occur and change their health status. Meanwhile, a minority indicated that their faith was strong and so they accepted their health status better than when their illness started. The majority of respondents indicated that they believe in a life after death, which provided some hope in the face of their hopeless health condition and made death and dying less painful. However, the majority did not believe in reincarnation, suggesting that they believed that once they died, there was no return. Those that indicated a belief in reincarnation (28.3%) also indicated that their belief would help them die with less pain.

Most believed that death was like a long sleep, however, several indicated that they could not assess death. This belief was fostered by the observation that when another terminally ill patient died by their side, they said that it looked as if they were sleeping; they did not struggle and the only change noticed was that they were placed under an oxygen mask. As a result, a fear developed whenever they saw another patient wearing an oxygen mask as they concluded that death was imminent. Otherwise, the majority of respondents indicated that they rarely thought of death and dying; and when they did, it was most common to do so when they were experiencing severe pain. Pain preoccupied the minds of the participants, so in addition to thinking about death, they also thought of the pain, and how the pain could be stopped.

Attitudes toward Medical Care

The majority indicated that they were confused with regard to their health status, which may suggest why 21.7 % of participants did not respond to this item. The majority of terminally ill patients indicated that their physicians had discussed their ailments with them. However, among those who had not discussed their ailment with their physician, many indicated that their physician did not even tell them the type of sickness they had. A strong majority indicated their perception that the medical staff felt that no life should be lost, which suggests that the terminally ill have the perception that most medical staff do not want the terminally ill to die and always try to keep them alive for as long as possible. Rooda, et al (1999) found that nurses with a greater fear of death exhibited fewer positive attitudes toward caring for dying patients and nurses who viewed death as a passageway to a happy afterlife demonstrated a more positive attitude in their care. Dunn, Otten and Stephen (2005), opined that nurses with greater exposure to dying patients reported more positive attitudes and no significant correlation between nurse's attitudes toward death and caring for dying patients. These findings are similar to this study's patients' perception that life of the terminally ill should be prolonged for as long as possible.

The Relationships between Attitudes and Demographic Variables

Chi-square analysis was used to identify relationships between attitudes of terminally ill patients and demographic variables of ethnic group (Igbo, Yoruba, or Benin), age, sex, religion (Traditional, Christian, or Islamic), education level (primary or secondary), marital status, and socio-economic status (low, middle, or high) (Table 1). The results indicated that terminally ill patients' attitudes toward dying were significantly related only to educational level.

Table 1. ***Chi-square Analysis of the Relationships between Demographic Characteristics of Respondents and Overall Attitude of Death and Dying***

Demographic Characteristics	χ^2	*df*	*p*
Ethnic group	1.76	2	0.415
Age	0.791	1	0.374
Sex	0.324	1	0.569
Religion	2.247	2	0.325
Education level	5.064*	1	0.024*
Marital Status	0.372	1	0.542
Socio-economic status	1.186	1	0.276

*$p < 0.5$.

The Chi-square analysis of attitude and educational level indicated that the observed frequency was more than the expected frequency of terminally ill patients whose attitude was negative toward death and dying and had a maximum of a primary education. On the other hand, observed frequency was more than the expected frequency of patients whose attitude was positive and had at least a secondary education (see Table 2). It is important to note that the majority of all terminally ill patients had a negative attitude toward death and dying.ÄHowever, it was concluded that that the attitude toward death and dying of the terminally ill patients with a primary education was significantly more negative than those patients with a secondary education.

Table 2. ***Percentage Distribution of Respondents and Chi-square on Attitude of the Terminally Ill Patients toward Death and Dying***

Attitudes	Frequencies (*n*)	Primary School	Secondary School
Negative			
	Observed	13	12
	Expected	9.5	15.5

χ^2 (1, $N = 60$) = 5.064, $p = .024$.

Conclusions

The majority of respondents felt sad, had negative feelings upon diagnosis, were not adequately prepared for death, had not attained all that they wanted in life, and did not want to die in spite of their terminal stage of their illness. In fact, the majority of respondents indicated it would not make dying easier if they thought they had a fulfilled life as death will come too soon. The majority disagreed that death was a blessing. Finally, the majority of terminally ill patients noted a change in their personality since they became ill

and changes in attitude of family/friends toward them.

The findings of this study led to the following conclusions. First, the attitude of the terminally ill patients is significantly negative toward death and dying. And secondly, there was a significant difference in the attitudes of the terminally ill patients based on educational level, where those with a maximum of a primary education had a more negative attitude than those with a secondary education. It appears that education on end of life care in schools was necessary to lessen the taboo around death and dying and normalizing it as a subject to discuss. This will eventually be transferred to homes and society. No other differences between demographic variables of ethnic group, age, sex, religion, marital status, or socio-economic status were found.

References

Babbie, E. R. (1975). *The practice of social research*. Belmont California: Wadsworth Publishing, Inc.

Dunn, K. S., Otten, C. & Stephen, E. (2005). Nursing experience and the care of dying patients. *Oncology Nursing Forum*. 32(1), 97-104.

Feudtner, C., Santucci, G., Feinstein, J. S., Snyder, C. R., Rourke, M. T., & Kang, T. I. (2007). Hopeful thinking and level of comfort regarding providing pediatric palliative care. A survey of hospital nurses. *Pediatrics*. 119(1), l86-192.

Foos—Graber, A. (1989). Attitude toward death and dying. http://Jeff stats. Articlebase. Com/ college.and —University.article.

Frommelt, K.H (1991). The effect of death education on nurses' attitudes toward caring for terminally ill persons and their families. *American Journal of Hospice and Palliative Care*, 8(3), 37-43.

Ipsos Mori (2011). *Attitudes toward death and dying*. NHS East England: Fulbourn.

Kalish, R. A. (1985). *Death, grief and caring relations*, 2nd ed. Monterey: Brooks/Cole.

Kerlinger, F. N. (1976). *Foundations of behavior research*. New York: Holt-Rinehart and Winton, Inc.

Lange, M., Thom, B., Kline, N. E. (2009) Assessing nurses' attitudes toward death and caring for dying patients in a comprehensive cancer center. Oncology Nursing *Forum*, 35(6), 955-959.

Olokor, C.O. (1998). Intervention strategy on attitudes of terminally ill patients toward death and dying in selected specialist hospitals. Unpublished PhD thesis.

Rooda, L.A., Clement, R., & Jordan, M. L. (1999). Nurses attitudes toward death and caring for dying patients. *Oncology Nursing Forum*. 26 (10), 1683-1687.

Ross, H.S., & Mico, P.R. (1980). *Theory and practice in health education*. Palo Alto: Mayfield Publishing Company.

Appendix

Attitudes of the Terminally Ill toward Death and Dying (N = 60)

Items and Response Choices	Value	Frequency	%
(1) Feeling on knowing that illness is terminal			
Sad but alright	1	53	88.3
Ready for anything	2	1	1.7
Miracle will occur	3	5	8.3
(2) Prepared for death			
Very well	1	8	13.3
Not adequate	2	45	75.0
Still preparing	3	3	5.0
No need to prepare	4	3	5.0
(3) Attainment of what they wanted in life			
Yes	1	10	16.7
No	2	49	81.6
(4) Want to die considering the state of their illness			
Yes	1	14	23.3
No	2	45	75.0
(5) Lifestyle contributing to illness			
Strong agreed	1	19	31.7
Agreed	2	3	5.0
Disagreed	4	4	6.7
Strongly disagreed	5	32	53.3
(6) Belief in life after death			
Yes	1	43	71.7
No	2	14	23.3
(7) Belief in reincarnation			
Yes	1	17	28.3
No	2	42	70.0
(8) Thought death is like a long sleep			
Yes	1	30	50
No	2	10	16.7
Don't know	3	15	25
Selected more than an option	4	1	1.7
(9) Frequency of thoughts of death and dying			
Everyday	1	6	10.0
Always	2	16	26.7
Every time	3	9	15.0
Rarely	4	27	45.0
(10) When does the thought of death and dying come			
Severe pains	1	23	38.3
Daily pains	2	10	16.7
Seeing relatives/friends	3	4	6. 7
(11) Death tragic only for the survivors			
Yes	1	31	56.7
No	2	23	38.3
(12) Death comes too soon			
Yes	1	32	53.3
No	2	25	41.7
(13) Death is a blessing			
Strongly agreed	1	20	33.3
Agreed	2	1	1.7
Disagreed	4	4	6.7
Strongly disagreed	5	33	55.0
(14) Attitude of the medical staff toward the patient			
Lose no lives	1	55	91.7
Little attention	2	4	6.6
(15) Attitude of the terminally ill to prolongation of life			
Positively	1	42	70.0
Negatively	2	17	28.3
(16) The mental health status of the terminally ill			
Confused	1	24	40.0
Suicide	2	3	5.0
Sorry for relatives	3	6	10.0
Cry continuously	4	14	23.3
(17) Faith			
Strengthened	1	40	66.7
Weakened	2	7	11.7
No Change	3	13	21.7
(18) Had stronger faith and accepted their condition			
Yes	1	30	50.0
No	2	26	43.3
(19) Negative feelings on diagnosis of illness			
Yes	1	40	66.7
No	2	20	33.3

(20) Awareness of spouse of terminal nature of illness			
Strongly agreed	1	15	25.0
Agreed	2	5	8.3
Disagreed	3	7	11.7
Strongly disagreed	4	19	31.7
(21) Fulfilled life making dying easier			
Yes	1	17	28.3
No	2	42	70.0
(22) Discussion of health condition with physicians			
Yes	1	40	66.7
No	2	20	33.3
(23) Change in personality			
Yes	1	45	75.0
No	2	15	25.0
(24) The change of attitude of family/friends			
Yes	1	37	61.7
No	2	20	33.3

NOTE: The sum of many questions did not add up to 100% because not all questions were answered by all the participants. ■

Comparison of Bioelectrical Impedance and Skinfolds with Hydrodensitometry in the Assessment of Body Composition in Healthy Young Adults

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Abstract

Bioelectrical impedance analysis (BIA) is a widely used method for estimating body composition, yet issues concerning its validity persist in the literature. The purpose of this study was to validate percentage of body fat (BF) values estimated from BIA and skinfold (SF) with those obtained from hydrodensitometry (HD). Percent BF values measured via hand-to-hand BIA (BIA-H), foot-to-foot BIA (BIA-F), sum of three skinfolds (SF-3), and sum of seven skinfolds (SF-7) were compared to HD in 64 young caucasian adults (33 males, 31 females, mean age ± SD = 21.2 ± 3.4 years) in the same morning. Correlations with HD ranged from r = .71 - .73 except for (BIA-F), which was r = .63. BIA-F significantly overpredicted body fatness (%BF) (t = 3.8, p < .001) in comparison with HD. BIA-H, SF-3, and SF-7 were not significantly different (SE = 0.78 - .83) from HD. Caution should be exercised when using BIA-F based on existing manufacturer's equations with young adults. These data suggest that BIA-H can produce acceptable body fat measures for young adults but is not superior to SF-3 estimates.

Key words: Body fatness, validity

Introduction

Accurate, noninvasive and easy to use field methods for assessing body composition are needed in clinical, community, and research settings to properly identify a client's health risk of excessively high or low body fatness. One of these methods, bioelectrical impedance analysis (BIA), is a growing technique that ranks similar to skinfold measurement in its accuracy, precision and objectivity (Houtkooper, Lohman, Going, & Howell,1996).

BIA is based on the principle of resistance to the flow of electrical current due to differences in water content of fat and lean tissue (Wagner & Heyward, 1999). Lean tissue contains large amounts of water and electrolytes and is a good conductor of electrical current. Fat tissue, on the other hand, is anhydrous and a poor conductor; therefore, the larger the fat tissue, the higher the resistance to electrical current and the higher the adiposity.

BIA has proven to be a popular method of body composition assessment because it is quick, inexpensive, and does not intrude upon the client's privacy. In many clinical and community settings, it has replaced skinfold measurement as the field method of choice. This may be in part due to the fact that accurate measurement of skinfolds is dependent on the technique, skill, and experience of the tester (Roche, 1996), whereas BIA may be administered by examiners with little or no experience. In addition, Wagner and Heyward (1999) note that "because it is difficult to obtain accurate SKF measurements on older adults and obese individuals due to loose connective tissue and large fatfolds, BIA is the preferred field method of estimating percent body fat (BF) in these populations," (p. 144).

Validation studies have been undertaken on a number of cohorts and have focused primarily on a comparison of BIA with criterion methods. The research is extensive and has produced equivocal findings. For example, a review of 18 BIA studies on athletes and body builders found significant differences between BIA and HD in 13 of them (Clark, et al., 1993; Clark, Kuta, & Sullivan, 1994; Clark, Bartok, Sullivan, & Schoeller, 2005; Colville, Heyward, & Sandoval, 1989; Cordain, Richau, & Johnson, 1995; Diboll & Moffit, 2003; Dixon, Deitrick, Pierce, Cutrufello, & Drapeau, 2005; Dixon, Deitrick, Cutrufello, Drapeau, & Lovallo, 2006; Hortobagyi, et al., 1992; Kilduff, Lewis, Kingsley, Owen, & Dietzig, 2007; Kirkendall, Grogan, & Bowers, 1991; Moon, Tobkin, Smith, et al., 2008a; Moon, Tobkin, Costa, et al., 2008b; Oppliger, Nielsen, & Vance, 1991; Oppliger, Nielsen, Shetler, Crowley, & Albright,1992; Utter, et al., 2005; Utter & Lambeth, 2010; Volpe, Melanson & Kline, 2010). Similarly, in 15 body composition studies on women, only 4 showed a high level of agreement between BIA and criterion methods (Andreoli, Melchiorri, & De Lorenzo, 2002; Brandon & Bond, 1999; Civar, Aktop, Tercan, Ozdol, & Ozer, 2006; Demura, Sato, & Kitabayashi, 2004; Eaton, Israel, O'Brien, Hortobagyi, & McCammon, 1993; Erselcan, Candan, Saruhan, & Ayca, 2000; Evans, Arngrimsson, & Cureton, 2001; Heyward, et al., 1992; Iswara, Lukito, & Schultink, 2007; Jakicic, Wing, & Lang, 1998; Lupoli, et al., 2004; Miyatake, Takenami, Kawasaki, & Fujii, 2005; Segal, Gutin, Presta, Wang, & Van Itallie, 1985; Stolarczyk, Heyward, Hicks, & Baumgartner, 1994; Stolarczyk, Heyward, Goodman, Grant, Kessler, et al., 1995). On the other hand, among active, young nonathletes, who were the focus of the present study, prior research found significant differences between BIA and reference methods in only one of four studies (Civar, Ozer, Aktop, Tercan, & Ayceman, 2003; Civar et al., 2006; Kaminsky & Whaley, 1993; Swartz, Swartz, Evans, King, & Thompson, 2002). In almost all of these studies the authors suggested further validation of BIA.

More recently, two second-generation BIA devices have replaced the traditional tetrapolar BIA in the marketplace - a foot-to-foot machine (BIA-F) resembling a bathroom scale, and a hand-to-hand machine (BIA-H). The Tanita TBF-315 Body Fat Monitor is a common BIA-F instrument in the marketplace. With the BIA-F, the individual stands barefoot on the footpads while a low-level electrical current is introduced into the body at a fixed frequency. The Omron Body Logic Fat Loss Monitor is a popular BIA-H instrument in which the individual stands erect with the arms extended shoulder-height and in front of the body. Each hand grasps one side of the handle on the device while the electrical current is introduced.

Previously, BIA-F and BIA-H have been compared to traditional tetrapolar BIA (Ritchie, Miller, & Smiciklas-Wright, 2005) and to reference methods but rarely to each other. Recently, Williams, Barnes, & Pujol (2010) compared two different BIA-

F models, the Tanita BF-350, Tanita BF-522, with three BIA-H instruments, the Omron HBF-500, Omron HBF-300 and Omron HBF-306 and found only the Omron HBF-500 to have a high level of agreement with DEXA. Considering the inherent possibilities of measurement inaccuracy using BIA, it is important for fitness specialists and other strength and conditioning professionals who utilize BIA instruments to understand the relative validities of these devices. Therefore, the purpose of this study was to compare BF measurements provided by foot-to-foot and hand-to-hand BIA to a criterion method (HD) and Jackson-Pollock skinfold measures.

Method

Participants and Procedures

Students from a midsize comprehensive university in the Southeastern United States were recruited from majors' classes, a campus recreation center, and by word of mouth. Individuals with physical limitations, those taking diuretics, or athletes involved in daily practices were excluded from study participation due to known BIA measurement standards (NIH, 1994). After providing consent, participants included 64 young, healthy Caucasian adults (33 males, 31 females (21 ± 3 years of age). The Institutional Review Board of the university granted approval for the study. The order of measurement was randomly assigned to participants as they entered the laboratory.

Body fatness via foot-to-foot BIA (BIA-F) was measured using the Tanita Body Fat Monitor, Model TBF-315 (Tanita Corporation of America, Inc., Arlington Heights, IL) to the nearest 0.1%. Subjects stood erect with bare feet on the device's footpads. Body fatness via hand-to-hand BIA (BIA-H) was measured using the Omron Body Logic Fat Loss Monitor (Omron Healthcare, Inc., Bannockburn, IL). Subjects stood erect with arms forward at shoulder height. The investigator asked the subject about the amount of physical activity performed weekly and selected either the adult or athlete mode depending on the response. Since BIA estimates have previously established reliability within the same activity mode setting (Cordain, Whicker & Johnson, 1988; Erceg, et al., 2010; Houtkooper et al., 1996; NIH, 1994), only singles measures for BIA-H and BIA-F were needed and therefore obtained.

Because BIA estimates are affected by changes in water content, hydration levels and blood circulation are known to have an effect. In accordance with manufacturer's specifications, participants were tested in early morning before water, food, caffeine, or alcohol intake, exercise or showering. Subjects verbally verified adherence to these instructions before testing. Temperature (21-22°C) and relative humidity (~740 mmHg) of the laboratory were maintained at a comfortable level throughout testing.

Skinfold measurements were taken with Harpenden skinfold calipers at carefully marked sites on the anterior thigh, anterior iliac crest, subscapular, chest, midaxilla, abdomen, and triceps by two experienced skinfold testers. Intertester reliability ($r = .97$) was established using a separate random sample of 10 college students from a class in exercise science. Harpenden skinfold calipers are widely accepted as the "Gold Standard" instrument for skinfold measurement (Whitehead, 1990). The calipers were calibrated for tension and with a substance of known width prior to testing. Sites were carefully marked and a minimum of two trials at rotating sites were taken. If the two measures at a site differed by more than 3 mm, a third measure was taken. The mean of the two closest measures was recorded and used in the calculation of BF.

Using anterior thigh, anterior iliac crest, and triceps measures (women) and anterior thigh, chest, and abdomen measures (men), body densities were determined (Jackson & Pollock, 1978; Jackson, Pollock & Ward,1980) and the Siri (1956) formula generated BF estimates from the sum of three skinfolds (SF-3). All seven measures were summed to compute the sum of seven skinfolds (SF-7), which then produced BF estimates.

Whole-body density was determined by underwater weighing in a fasted state. After determining body mass in air to the nearest 0.1 kg on a Detecto scale, residual volume was measured using spirometry. Following this, participants entered the underwater weighing tank and were seated in a chair suspended from a 9-kg Chatillion autopsy scale. A minimum of seven measurements were taken to obtain three weights within 100 g (Bonge & Donnelly, 1989). The mean of the three highest trials was used as the underwater weight. Body density values were converted to BF using the Siri equation (1956). The reader is referred to the classic work of Behnke and Wilmore (1974) and the later article by Wagner and Heyward (1999) for more thorough reviews of these techniques.

Analysis of Data

Pearson product-moment correlations were calculated between HD and each of the field methods. Paired t-tests were used to compare the mean BF of the methods. Significance was set at $p < .01$ to reflect the increased chance of error associated with multiple t-test comparisons. All analyses were performed using SPSS version 17.0.

Results

Mean (±SD) BF for all methods of body composition analysis are presented in Table 1. Only BIA-F was found to be significantly different from HD ($p < .01$) in its estimate of BF.

Table 1. ***Descriptive Statistics for Body Composition Methods (%BF)***

Method		Females (n=31)	Males (n=33)	Both (n=64)
BIA-F	M	25.8	19.1	22.4*
	SD	6.9	7.6	8.0
BIA-H	M	20.6	16.1	18.3
	SD	5.5	6.5	6.4
SF-3	M	21.6	15.5	18.5
	SD	5.6	6.3	6.7
SF-7	M	21.9	15.3	18.5
	SD	5.4	6.2	6.7
HD	M	21.0	17.8	19.3
	SD	5.3	6.8	6.3

BIA-F = Tanita TBF-515 Body Fat Monitor/Scale (Foot-to-Foot)
BIA-H = Omron Body Logic Fat Loss Monitor (Hand-to-Hand)
SF-3 = Sum of Three Skinfolds
SF-7 = Sum of Seven Skinfolds
HD = Hydrodensitometry
* Significantly different from HD, $p < .01$

Significant intermethod agreement (Table 2) was demonstrated between each of the methods and HW ($p < .01$). Correlations between the two bioelectrical impedance measures, BIA-F and BIA-H, with HD were $r = 0.63$ and $r = 0.73$ respectively.

Table 2. ***Correlations between Bioelectrical Impedance, Skinfolds and Hydrodensitometry.***

	BIA-F	BIA-H	HD	SF-3	SF-7
BIA-F	1.0	.61*	.63*	.66*	.65*
BIA-H	.61*	1.0	.73*	.69*	.73*
HD	.63*	.73*	1.0	.71*	.72*
SF-3	.66*	.69*	.71*	1.0	.92*
SF-7	.65*	.73*	.72*	.92*	1.0

*Significant at $p < .01$

The correlation between BIA-F and its sister method, BIA-H, was $r = 0.61$. BIA-F significantly overpredicted BF ($t = 3.8$, $p < .001$) in comparison with HD (Table 3). The skinfold measures consistently underpredicted BF in comparison with HD. The small differences (1.0 – 1.2%) in BF with BIA-H, SF-3, and SF-7 were not significantly different from HD.

Table 3. ***Summary of Mean Differences From Hydrodensitometry (%BF).***

Method	MD	SD	95% CI	*t*
BIA-F	3.042	6.348	1.46 - 4.63	3.83*
BIA-H	-1.014	4.640	-2.17 - .14	-1.75
SF-3	-0.886	4.950	-0.35 – 2.12	1.43
SF-7	-0.792	4.896	-0.43 – 2.02	1.30

* Significant at $p < 0.01$
MD = mean difference
SD = standard deviation
95% CI = 95% confidence interval

Discussion

The results of this study on the validity of the BIA-F and BIA-H methods demonstrated generally high intermethod agreement among BIA, skinfolds and HD. The only significantly different estimate of BF from HD was found with the BIA-F method (mean difference – 3.1%).

A review of more than 70 previous BIA studies with different cohorts found considerable variability in intermethod agreement. Among non-obese, adult non-athletes, some evidence supports the validity of BIA with this population (Biaggi et al., 1999; Eaton et al., 1993; Erceg et al., 2010; Erselcan et al., 2000; Evans et al, 2001; Heyward et al., 1992; Kaminsky & Whaley, 1993; Kremer et al., 1998; Kyle et al., 2004; Levenhagan et al., 1999; Maughan, 1993; Moon et al., 2008a; Ross et al., 1989; Swartz et al., 2002; Unick, Utter, Schumm, & McInnis, 2006).

In some studies, BF differences between BIA and reference methods were significant. BIA overestimated BF by more than 3% and 4% in men and women when BF was higher than 15% and 25% respectively (Sun et al., 2005). In a study on young, healthy women, Andreoli et al., found a significant difference in BF between a Tanita bipedal BIA and DEXA (2002). Paijmans, Wilmore and Wilmore compared BIA and SF with HD in individuals who underwent rapid weight loss and found significant differences between methods (1992).

In another study, Williams et al., found differences between DEXA and five different BIA instruments, including both BIA-H and BIA-F models, in a study on young adult nonathletes (2010). No explanation was offered by the authors to explain this discrepancy. However, earlier work suggests that the different equations used for athletes and non-athletes may have created some bias (Fogelhom & van Marken Lichtenbelt, 1997). Alternately, variations in fluid distribution may have manifested these differences. This study is interesting because fitness practitioners who measure their clients' BF may be likely to pick up the most readily available BIA instrument, believing it to be accurate, and this may not be the case.

Kyle, et al., (2004) have suggested that BIA works well in healthy subjects with stable water and electrolytes balance with a BIA equation appropriate to age, sex and race. On the other hand, Dehghan and Merchant (2008) have cautioned against the use of BIA for large epidemiological populations where race, ethnic group, and conditions vary. Based on this and earlier research, BIA-H would appear to be a reasonably valid method of body composition analysis for use with adult non-obese Caucasians, whereas BIA-F is a less acceptable alternative method with this population.

Future research should assess the validity of bioelectrical impedance analysis among more culturally diverse samples, with older adults and obese individuals.

References

Andreoli, A., Melchiorri, G., & De Lorenzo, A. (2002). Bioelectrical impedance measures in different position and vs dual-energy X-ray absorptiometry (DXA). *Journal of Sports Medicine and Physical Fitness*, 42(2), 186-189.

Behnke, A., & Wilmore, J. (1974). *Evaluation and Regulation of Body Build and Composition*. Englewood Cliffs, NJ: Prentice-Hall.

Biaggi, R.R., Vollman, M.W., Nies, M.A., Brener, C.E., Flakoll, P.J., Levenhagen, D.K., Sun, M., Karabulut, Z., & Chen, K.Y. (1999). Comparison of air-displacement plethysmography with hydrostatic weighing and bioelectrical impedance analysis for the assessment of body composition in healthy adults. *American Journal of Clinical Nutrition*, 69(5), 898-903.

Bonge, D., & Donnelly, J.E. (1989). Trials to criteria for hydrostatic weighing at residual volume. *Research Quarterly for Exercise and Sport*, 60, 176-179.

Brandon, L.J., & Bond, V. (1999). Are practical methods of evaluating body fat in African-American women accurate? *American Journal of Health Promotion*, 13(4), 200-202.

Civar, S., Ozer, K., Aktop, A., Tercan, E., & Ayceman, N. (2003). Validity of leg-to-leg bioelectrical impedance measurement in highly active males. *Biology of Sport*, 20(3), 209-219.

Civar, S., Aktop, A., Tercan, E., Ozdol, Y., & Ozer, K. (2006). Validity of leg-to-leg bioelectrical impedance measurement in highly active women. *Journal of Strength and Conditioning Research*, 20(2), 359-365.

Clark, R.R., Kuta, J.M., Sullivan, J.C., Bedford, W.M., Penner, J.D., & Studesville, E.A. (1993). A comparison of methods to predict minimal weight in high school wrestlers. *Medicine and Science in Sports and Exercise*, 25(1), 151-158.

Clark, R.R., Kuta, J.M., Sullivan, J.C. (1994). Cross-validation of methods to predict body fat in African-American and Caucasian collegiate football players. *Research Quarterly for Exercise and Sport*, 65(1), 21-30.

Clark, R.R., Bartok, C., Sullivan, J.C., & Schoeller, D.A. (2005). Is leg-to-

leg BIA valid for predicting minimum weight in wrestlers? *Medicine and Science in Sports and Exercise*, 37(6), 1061-1068.

Colville, B.C., Heyward, V.H., & Sandoval, W.M. (1989). Comparison of two methods for estimating body composition of bodybuilders. *Journal of Applied Sport Science Research*, 3(3), 57-61.

Cordain, L., Whicker, R.E., & Johnson, J.E. (1988). Body composition determination in children using bioelectrical impedance. *Growth, Development, and Aging*, 52(1), 37-40.

Cordain, L., Richau, L.L., & Johnson, J.E. (1995). Variability of body composition assessments in men exhibiting extreme muscular hupertrophy. *Journal of Strength and Conditioning Research*, 9(2), 85-89.

Dehghan, M., & Merchant, A.T. (2008). Is bioelectrical impedance accurate for use in large epidemiological studies? *Nutrition Journal*, 7, 7.

Demura, S., Sato, S., & Kitabayashi, T. (2004). Percentage of total body fat as estimated by three automatic bioelectrical impedance analyzers. *Journal of Physiological Anthropology and Applied Human Science*, 23(3), 93-99.

Diboll, D.C., & Moffit, J.K. (2003). A comparison of bioelectrical impedance and near- infared interactance to skinfold measures in determining minimum wrestling weight in collegiate wrestlers. *Journal of Exercise Physiology- online*, 6(2), 26-36.

Dixon, C.B., Deitrick, R.W., Pierce, J.R., Cutrufello, P.T., & Drapeau, L.L. (2005). Evaluation of the BOD POD and leg-to-leg bioelectrical impedance analysis for estimating percent body fat in National Collegiate Association Division III collegiate wrestlers. *Journal of Strength and Conditioning Research*, 19(1), 85-91.

Dixon, C.B., Deitrick, R.W., Cutrufello, P.T., Drapeau, L.L., & Lovallo, S.J. (2006). Effect of mode selection when using leg-to-leg BIA to estimate body fat n collegiate wrestlers. *The Journal of Sports Medicine and Physical Fitness*, 46(2), 265-270.

Eaton, A.W., Israel, R.G., O'Brien, K.F., Hortobagyi, T., & McCammon, M.R. (1993). Comparison of four methods to assess body composition in women. *European Journal of Clinical Nutrition*, 47(5), 353-360.

Erceg, D.N., Dieli-Conwright, C.M., Rossuello, A.E., Jensky, N.E., Sun, S., & Schroeder, E.T. (2010). The Stayhealthy bioelectrical impedance analyzer predicts body fat in children and adults. *Nutrition Research*, 30(5), 297-304.

Erselcan, T., Candan, F., Saruhan, S., & Ayca, T. (2000). Comparison of body composition analysis methods in clinical routine. *Annals of Nutrition and Metabolism*, 44(5-6), 243-248.

Evans, E.M., Arngrimsson, S.A., & Cureton, K.J. (2001). Body composition estimates from multicomponent models using BIA to determine body water. *Medicine and Science in Sports and Exercise*, 33(5), 839-845.

Fogelholm, M., & van Marken Lichtenbelt, W. (1997). Comparison of body composition methods: a literature analysis. *European Journal of Clinical Nutrition*, 51, 495-503.

Heyward, V.H., Cook, K.L., Hicks, V.L., Jenkins, K.A., Quatrochi, J.A., & Wilson, W.L. (1992). Predictive accuracy of three field methods for estimating relative body fatness of nonobese and obese women. *International Journal of Sport Nutrition*, 2(1), 75-86.

Hortobagyi, T., Israel, R.G., Houmard, J.A., O'Brien, K.F., Johns, R.A., & Wells, J.M. (1992). Comparison of four methods to assess body composition in black and white athletes. *International Journal of Sport Nutrition*, 2(1), 60-74.

Houtkooper, L.B., Lohman, T.G., Going, S.B., & Howell, W.H. (1996). Why bioelectrical impedance analysis should be used for estimating adiposity. *American Journal of Clinical Nutrition*, 64(Suppl.), 436S-448S.

Iswara, R., Lukito, W., & Schultink, J.W. (2007). Comparison of body compositional indices assessed by underwater weighing, bioelectrical impedance and anthropometry in Indonesian adolescent girls. *Asia Pacific Journal of Clinical Nutrition*, 16(4), 641-648.

Jackson, A.S., & Pollock, M.L. (1978). Generalized equations for predicting body density of men. *British Journal of Nutrition*, 40, 497-504.

Jackson, A.S., Pollock, M.L., & Ward, A. (1980). Generalized equations for predicting body density of women. *Medicine and Science in Sports and Exercise*, 12, 175-182.

Jakicic, J.M., Wing, R.R., & Lang, W. (1998). Bioelectrical impedance analysis to assess body composition in obese adult women, *International Journal of Obesity and Related Metabolic Disorders*, 22(3), 243-250.

Kaminsky, L.A., & Whaley, M.H. (1993). Differences in estimates of percent body fat using bioelectrical impedance. *Journal of Sports Medicine and Physical Fitness*, 33(2), 172-177.

Kilduff, L.P., Lewis, S., Kingsley, M.C., Owen, N., & Dietzig, R.E. (2007). Reliability and detecting change following short-term creatine supplementation: comparison of two-component body composition methods. *Journal of Strength and Conditioning Research*, 21(2), 378-384.

Kirkendall, D.T., Grogan, J.W., & Bowers, R.G. (1991). Field comparison of body composition techniques: hydrostatic weighing, skinfold thickness, and bioelectrical impedance. *Journal of Orthopedic Sports Physical Therapy*, 13(5), 235-239.

Kremer, M.M., Latin, R.W., Berg, K.E., & Stanek, K. (1998).Validity of bioelectrical impedance analysis to measure body fat in Air Force members. *Military Medicine*, 163(11), 781-785.

Kyle, U.G., Bosaeus, I., De Lorenzo, A.D., Deurenberg, P., Elia, M., Manuel Gomez, J., Lilienthal Heitmann, B., Kent-Smith, L., Melchior, J.C., Pirlich, M., Scharfetter, H.M.W.J., Schols, A., & Pichard, C. (2004). Bioelectrical impedance analysis-part II: utilization in clinical practice. *Clinical Nutrition*, 23(6), 1430-1453.

Levenhagen, D.K., Borel, M.J., Welch, D.C., Piasecki, J.H., Piasecki, D.P., Chen, K.Y., & Flakoll, P.J. (1999). A comparison of air displacement plethysmography with three other techniques to determine body fat in healthy adults. *Journal of Parenteral and Enteral Nutrition*, 23(5), 293-299.

Lupoli, L., Sergi, G., Coin, A., Perissinotto, E., Volpato, S., Busetto, L., Inelmen, E.M., & Enzi, G. (2004). Body composition in underweight elderly subjects: reliability of bioelectrical impedance analysis. *Clinical Nutrition*, 23(6), 1371-1380.

Maughan, R.J. (1993). An evaluation of a bioelectrical impedance analyser for the estimation of body fat content. *British Journal of Sports Medicine*, 27(1), 63-66.

Miyatake, N., Takenami, S., Kawasaki, Y., & Fujii, M. (2005). Comparison of air displacement plethysmograph and bioelectrical impedance for assessing body composition changes during weight loss in Japanese women. *Diabetes, Obesity and Metabolism*, 7(3), 268-272.

Moon, J.R., Tobkin, S.E., Smith, A.E., Roberts, M.D., Ryan, E.D., Dalbo, V.J., Lockwood, C.M., Walter, A.A., Cramer, J.T., Beck, T.W., & Stout, J.R. (2008). Percent body fat estimations in college men using field and laboratory methods: A three-compartment model approach. *Dynamic Medicine*, 7, 7.

Moon, J.R., Tobkin, S.E., Costa, P.B., Smalls, M., Mieding, W.K., O'Kroy, J.A., Zoeller, R.F., & Stout, J.R. (2008). Validity of the BOD POD for assessing body composition in athletic high school boys. *Journal of Strength and Conditioning Research*, 22(1), 263-269.

Oppliger, R.A., Nielsen, D.H., & Vance, C.G. (1991). Wrestlers' minimal weight: anthropometry, bioimpedance, and hydrostatic weighing compared. *Medicine and Science in Sports and Exercise*, 23(2), 247-253.

Oppliger, R.A., Nielsen, D.H., Shetler, A.C., Crowley, E.T., & Albright, J.P. (1992). Body composition of collegiate football players: bioelectrical impedance and skinfolds compared to hydrostatic weighing. J*ournal of Orthopedic Sports Physical Therapy*, 15, 187-192.

Paijmans, I.J., Wilmore, K.M., & Wilmore, J.H. (1992). Use of skinfolds and bioelectrical impedance for body composition assessment after weight reduction. *Journal of the American College of Nutrition*, 11(2), 145-151.

Ritchie, J.D., Miller, C.K., & Smiciklas-Wright, H. (2005). Tanita foot-to-foot bioelectrical impedance analysis system validated in older adults. *Journal of the American Dietetic Association*, 105, 1617-1619.

Roche, A.F. (1996). Anthropometry and ultrasound. In A.F. Roche, S.B. Heymsfield, T.G. Lohman (Eds). *Human Body Composition*.

Champaign, IL: Human Kinetics.

Ross, R., Leger, L., Martin, P., & Roy, R. (1989). Sensitivity of bioelectrical impedance to detect changes in human body composition. *Journal of Applied Physiology*, 67(4), 1643-1648.

Segal, K.R., Gutin, B., Presta, E., Wang, J., & Van Itallie, T.B. (1985). Estimation of human body composition by electrical impedance methods: a comparative study. *Journal of Applied Physiology*, 58(5), 1565-1571.

Siri, W.S. Gross composition of the body. (1956). In J.H. Lawrence & C.A. Tobias (Eds). *Advances in Biological and Medical Physics*. New York: Academic Press.

Stolarczyk, L.M., Heyward, V.H., Hicks, V.L., & Baumgartner, R.N. (1994). Predictive accuracy of bioelectrical impedance in estimating body composition of Native American women. *The American Journal of Clinical Nutrition*, 59(5), 964-970.

Stolarczyk, L.M., Heyward, V.H., Goodman, J.A., Grant, D.J., Kessler, K.L., Kocina, P.S., & Wilmerding, V. (1995). Predictive accuracy of bioimpedance equations in estimating fat-free mass of Hispanic women. *Medicine and Science in Sports and Exercise*, 27(10), 1450-1456.

Sun, G., French, C.R, Martin, G.R, Younghusband, B., Green, R.C., Xie, Y.G., Mathews, M., Barron, J.R., Fitzpatrick, D.G., Gulliver, W., & Zhang, H. (2005). Comparison of multifrequency bioelectrical impedance analysis with dual-energy X-ray absorptiometry for assessment of percentage body fat in a large, healthy population. *American Journal of Clinical Nutrition*, 81(1), 74-78.

Swartz, A.M., Swartz, A.M., Evans, J.M., King, G.A., & Thompson, D.L. (2002). Evaluation of a foot-to-foot bioelectrical impedance analyzer in highly active, moderately active and less active young men. *British Journal of Nutrition*, 88(2), 205-210.

Unick, J.L., Utter, A.C., Schumm, S., & McInnis, T. (2006). Evaluation of leg-to-leg BIA in assessing body composition in high-school-aged males and females. *Research in Sports Medicine*, 14(4), 301-313.

U.S. National Institutes of Health. Office of Medical Applications of Research. (1994). Bioelectrical impedance analysis in body composition measurement. *National Institutes of Health Technology Assessment Conference statemen*t.

Utter, A.C., Nieman, D.C., Mulford, G.J., Tobin, R., Schumm, S., McInnis, T., & Monk, J.R. (2005). Evaluation of leg-to-leg BIA in assessing body composition of high-school wrestlers. *Medicine and Science in Sports and Exercise*, 37(8), 1395-1400.

Utter, A.C., & Lambeth, P.G. (2010). Evaluation of multifrequency bioelectrical impedance analysis in assessing body composition of wrestlers. *Medicine and Science in Sports and Exercise*, 42(2), 361-367.

Volpe, S.L., Melanson, E.L., & Kline, G. (2010). Validation of bioelectrical impedance analysis to hydrostatic weighing in male body builders. *Acta Diabetologica*, 47(1), 55-58.

Wagner, D.R., & Heyward, V.H. (1999). Techniques of body composition assessment: a review of laboratory and field methods. *Research Quarterly for Exercise and Sport*, 70(2), 135-149.

Whitehead, J.R. (1990). A study of the measurement variation among different skinfold calipers. *British Journal of Physical Education (Research Supplement)*, 7, 10-14.

Williams, R.D., Barnes, J.T., & Pujol, T.J. (2010). Comparison of body composition assessment techniques in a non-athletic, non-obese young adult population. *Journal of Strength and Conditioning Research*, 24(1), 1. ■

Exercise Induced Cardiac Fatigue Following Prolonged Exercise in Road Cyclists

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Abstract

The purpose of this study was to examine cardiac function following a 100-mile ride in high ambient temperatures by healthy, competitive cyclists. Methods: Subjects were six (n=6) competitive cyclists racing in a 100-mile road race. Measures (pre/post) included: body mass (kg); E:A ratio (ventricular compliance); stroke volume (ml); ejection fraction (%) through echocardiography; age (y); training status (hrs*week^{-1}); years of racing experience (YE); race finish time (hrs); height (cm); mean race heart rate (b*min^{-1}), and post race blood troponin I (cTnI) to assess myocyte damage. Results: subject means (±SE) were the following: age, 24.2 (1.2) y; height, 181.1 (5.5) cm; training status, 18 (2.4) hrs*week^{-1}; racing experience, 5.8 (4.6) y; race heart rate,159.3 (3.9) b*min^{-1}; pre/post E:A ratio, 2.04(.41)/ 1.27(.39); pre/post stroke volume, 98.6 (21.6)/ 72.6(11.8) ml*min^{-1}; cTnI, 0.13 (.15); ejection fraction pre/post, 67.3 (3.8)/ 65.1(2.2)%; finish time 4.05 (0.54) hrs. Significant ($p< 0.05$) differences were determined pre/post for E:A ratio, stroke volume, and pre/post body mass, 76.4 (5.9)/ 72.4 (1.8) kg. cTnI was elevated above established levels of 0.03 ng*ml^{-1} for cellular disruption. Conclusion: The differences in E:A ratio (i.e., ventricular compliance), stroke volume and elevated cTnI indicate reduced cardiac function indicative of cardiac fatigue.

Key Words: echocardiography, cardiac damage.

Introduction

Exercise induced cardiac dysfunction is generally associated with cardiovascular disease. However, a transient reduction in systolic and diastolic performance after prolonged exercise has been successfully demonstrated by many researchers (Bonetti et al., 1996; Douglas, O'Toole, Hiller, Hackney & Reichek, 1987; Konig et al., 2003; Middleton et al., 2007; Niemela, Palatsi, Ikaheimo, Takkunen & Vuori, 1984; Rafai, Douglas, O'Toole, Rimm & Ginsberg, 1999; Rowe, 1993; Seals et al., 1988; Shave et al., 2004; Tulloh, et al., 2006; Vanoverschelde et al.,1991). This can be identified by various signs, such as decreased cardiac contractility, altered diastolic function and septal wall motion abnormalities. Additionally, transitory elevation of cardiac markers, indicative of cardiac damage are shown following prolonged duration of exercise (Koller, 2003; Middleton et al.; Neumayr, et al., 2001).

It is well recognized that chronic cardiac endurance training induces a number of morphological and cardiovascular adaptations such as decreased resting heart rate, left ventricular hypertrophy, and increased stroke volume (Middleton, Shave, George, Whyte, Hart, & Atkinson, 2006). As cardiac output is a product of heart rate and stroke volume, increased requirement of oxygen during prolonged exercise demands increased cardiac activity (Braunwald et al., 2001; Sagiv, Ben-Sira, Goldhammer & Soudry, 2000). This increase in cardiac workload for a prolonged duration may result in a transient impairment in cardiac function (Middleton et al.). In the absence of any underlying cardiovascular diseases, this impairment may be attributed to a condition referred to as exercise induced cardiac fatigue (EICF) (Middleton et al.; Starnes, Wilson & Erecinska, 1985; Whyte et al., 2000). Yet, some research indicates a lack of evidence toward a decrease in cardiac performance after prolonged exercise (Goodman, McLaughlin & Liu, 2001). This may be attributed to variations in the methods employed, specifically the exercise duration and the training status of participants (Middleton et al.).

The study of exercise induced cardiac fatigue has mainly focused on trained athletes participating in prolonged endurance events such as triathlons, marathon running and cycling. These studies have been limited by various confounding factors such as duration, intensity, and environmental conditions. Individuals not competitively engaged in an endurance exercise program appear to have a much lower threshold and less tolerance for prolonged endurance exercise. Thus, these non-competitive individuals may experience cardiac fatigue after a shorter amount of time and lower intensities of exercise than competitive endurance athletes (Seals et al., 1988; Vanoverschelde et al., 1991). Although there is no unanimity to the cause of exercise induced cardiac fatigue, many hypotheses have been used to explain the cardiac dysfunction experienced in the absence of cardiovascular disease. These include fatty acid accumulation, prolonged tachycardia, and catecholamine elevations (Rifai et al., 1999). Decreased systolic function of the heart has been attributed to a depressed inotropic state (Douglas et al., 1987; Douglas, O'Toole & Woolard, 1990; Mole & Coulson, 1995; Niemela, Palatsi, Ikaheimo, Airaksinen & Takkunen, 1987; Niemela et al., 1984; Seals et al., 1988; Vanoverschelde et al., 1991) while diastolic dysfunction has been attributed to altered volume loading (Douglas et al.; Niemela et al.). Septal wall abnormalities suggestive of ischemia have also been identified (Douglas et al.). Following the completion of prolonged strenuous exercise, athletes often exhibit left ventricular dysfunction (Middleton et al., 2006). Additionally, elevated levels of cardiac enzymes indicative of myocyte damage, such as creatinine kinase MB (CK-MB), cardiac troponin-T (cTnT), and cardiac troponin- I (cTnI) may be noted following endurance events. Cardiac troponin-T and cTnI are not normally detected in the serum of healthy subjects at rest and are therefore highly sensitive and specific indicators of injury to the heart (Bonetti et al., 1996; Rifai et al., 1999; Shave et al., 2002). Currently, cTnI is the most sensitive and specific marker for the myocardial necrosis detection even in the presence of damage to skeletal muscles (Denvir et al., 1999; Koller, 2003; Neumayr et al., 2001).

Lastly, cardiac fatigue in the absence of myocardial necrosis has been previously described as myocardial stunning (Whyte et al., 2000). This may be the result of transient ischemia during exercise and associated with the accumulation of oxygen free radicals (Whyte et al.). Therefore, it is the purpose of this study to examine cardiac fatigue following a 100 mile ride in a high ambient

temperature environment by healthy, competitive cyclists. It is hypothesized that following an extended period of work associated with endurance performance (i.e., competitive cycling), markers for cardiac fatigue will be noted through echocardiography and elevated blood cTnI levels. Utilizing an environment of work (i.e., 100 m bike ride) coupled with high ambient temperature conditions (98.6° F) the researchers purposely chose this venue for eliciting possible EICF. The examination of the aforementioned blood markers and echocardiography in the current study provides a multifaceted approach to confirmation of cardiac fatigue. From these findings, future research may focus on recovery markers resulting from the associated cardiac fatigue. Recognition or confirmation of cardiac fatigue recovery in competitive endurance athletes provide evidence of specific stress markers associated with specific adaptation responses.

Methods

The Hotter-N-Hell™ Hundred is one of the oldest and largest one day cycling events in the United States. It is held each year in August when temperatures often exceed 100°F during later portions of the race. Six (6) subjects participating in this bicycle ride were selected for this study. Prior to testing, all subjects were administered a medical health questionnaire, a PAR-Q Fitness Readiness questionnaire and signed a Midwestern State University Institutional Review Board approved informed consent. Pre-race measurements were taken 36 hours (h) before the race. Post-race measurements were taken immediately following each individual's finish of the race.

Pre Race Measurements

Subjects descriptive characteristics included mean (+SE) for the following; age (y), gender (M/F), height (m), body mass (kg), body mass Index (BMI), training status (hrs*week^{-1}), and years of experience (YE). Body mass was measured on a Health o meter™ beam scale (Jarden Corporation, Providence, RI) with subjects in bare feet and shorts. A two dimensional echocardiographic assessment was completed by a single, experienced sonographer, in accordance with the guidelines established by the American Society of Echocardiography. Assessment was completed by using a Hewlett-Packard Philips Sonos 5500™ (Palo Alto, CA). Subjects were instructed to lie in the left lateral decubitus position. Stroke volume (L*min^{-1}), ejection fraction (%) along with peak early filling (E waves/cm) and peak late filling (A wave/cm) velocities were measured. Additionally, the ratio of early to late diastolic filling (E:A) was calculated in order to establish diastolic function of the heart (Schiller, Shah, Crawford, Demaria, Devereux, Feigenbaum, Gutgussel, Reichek, Sahn, Schittger, Silverman & Tajik, 1989). Three to five measures were obtained with three consecutive and consistent measures averaged. This was done to maintain tester reliability within each measure.

Post Race Measures

Following the race, each subject immediately came to the established medical tent where post race measures were conducted. Initially, subject hydration status was checked for any evidence of dehydration through urine sample color followed by body mass (kg) and mean heart rate (b*min.$^{-1}$). Hydration was measured to ensure blood volume was not a factor associated with altered cTNI levels. Once they were stabilized (i.e, recovered) in the supine position, the blood measurements and echocardiography were taken. These measures were approximately 15 min post race with the blood stored in a cooler with dry ice for later analysis. Cardiac troponin I levels (cTnI) were determined by immunochemiluminescence (ECL) technology employed within the Beckman Coulter DXI Analyzer™ (Brea, CA). The established cut off value for myocardial injury for cTnI is 0.5 ng*ml^{-1} and detection limit (i.e., elevation detection) was 0.03 ng*ml^{-1} (Collinson, Boa & Gaze, 2001).

Statistics

Mean (SE) was determined for descriptive data. To determine pre/post race statistical differences, a dependent samples t-Test was performed. Cardiac troponin I levels were analyzed for clinical significance established at 0.03 ng*ml^{-1} utilizing a □square test for single sample. Correlation analyses were performed using a Pearson Product R Correlation Coefficient to determine possible bivariate associations between variables. Alpha (p) value for statistical significance was set a *priori* at $p \leq 0.05$. All statistics were performed using Statistica-7TM (Tulsa, OK).

Results

The subjects were six (6) college aged male cyclists participating in the Hotter-N-Hell™ 100 mile bicycle ride with the following descriptive measures (mean ± SE) in Table 1.

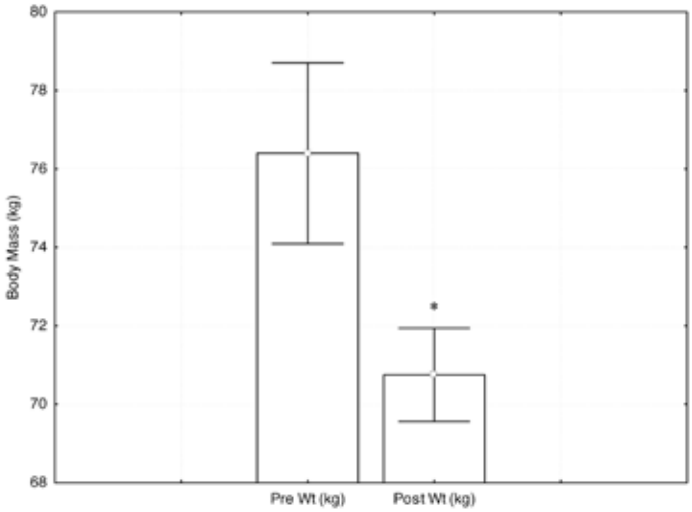
Table 1. ***Subject Mean (SE) Descriptive Measures***

Measure	Mean	SE
Age (y)	24.2	0.47
TS (hrs*wk-1)	18	1.00
YE (y)	5.83	1.87
Height (cm)	181	2.00
Pre Body Mass (kg)	76.4	2.43
Post Body Mass (kg)	70.75*	1.25
Race HR (b*min-1)	159.3	1.59

Note: TS - Training Status; YE-years of cycling experience; HR-heart rate; *Statistically significant at p=0.02

Out of six, four completed the 100 miles in 4.40±0.04 hrs, while two finished 80 miles after being dropped by the leaders of the race. The two that rode 80 m were not excluded because the endurance time on the bike exceeded four (4) hours and the ambient temperature during the ride reached 98.6° F. Body mass pre race 76.4±5.94 kg was significantly (p= 0.02, t=3.55) reduced post race 70.7±3.18 kg (See Figure 1). Mean (SE) heart rate was 159.3 ± 1.59 b*min^{-1}. Correlation analysis revealed no significant associations between measured variables.

Figure 1
Mean (SE) Pre-Post Race Measures of Body Mass.

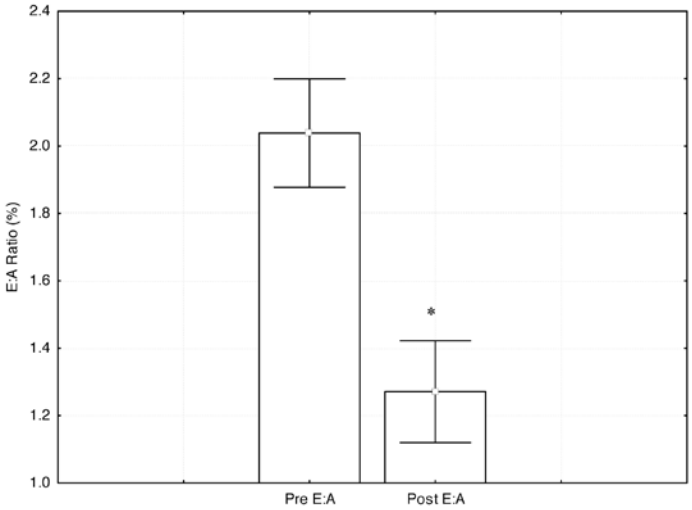


*Statistically significant at p=0.02

Echocardiographic Data

Early (E) and late (A) diastolic filling were not significantly reduced (p= 0.06). However, the resultant early to late diastolic filling ratio (E:A) between pre and post race were significantly different (p= 0.002, t=5.75). Graphic comparisons of E:A ratio pre and post race can be seen in Figure 2.

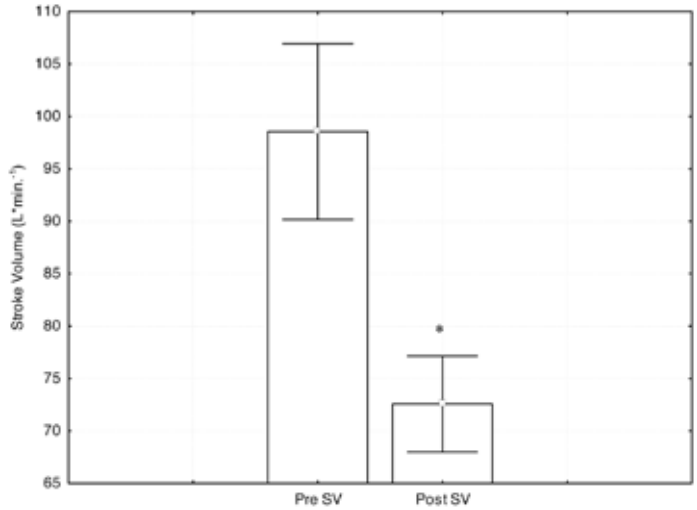
Figure 2
Mean (SE) Pre-Post Race Measures in Diastolic function (E:A ratio)



*Statistically significant p=0.002

Stroke volume (L*min^{-1}) was significantly reduced (p= 0.02, t=3.21) post race in all subjects (Figure 3).

Figure 3
Mean (SE) Pre-Post Race Measures in Stroke Volume.



*Statistically significant p=0.02

While ejection fraction was reduced, it did not reach statistical significance (p= 0.29,
t=1.16).

Blood Data

Following the race, cTnI levels increased in all subjects. The increase was moderate or indeterminate grade (i.e. between 0.03-0.5 ng*ml^{-1}) with a mean of 0.13 ± 0.06 ng*ml^{-1}. One subject showed increase in cTnI level of 0.45 ng*ml^{-1}, which nears the acute myocardial infarction cutoff value of 0.5 ng*ml^{-1} (Collinson et al., 2001). This indicates that there was myocardial cellular disruption, though statistically not significant (p= 0.17). While subject values varied within the group, they were maintained with analysis primarily focused toward clinical implications toward the aforementioned cTnI levels (i.e., 0.03-0.5 mg*ml^{-1}). All subjects exceeded clinical levels of cTnI indicating myocardial disruption in their post race blood analysis.

Discussion

The findings of this study indicate that after prolonged exercise in high ambient temperatures, cardiac dysfunction as well as myocardial cellular disruption in competitive, healthy male cyclists is evident. The current study found a significant decrease in diastolic function denoted by the decreased E:A ratio. The significant decrease in stroke volume and decrease in ejection fraction indicates additional systolic dysfunction. While the mechanisms of this systolic and diastolic dysfunction are not clear, a number of possibilities have been proposed. Additionally, this study found evidence of myocardial cellular disruption indicated by moderate elevations of cTnI after the race. A Pearson Product R Correlation Coefficient did not reveal associations between the significant decline in cardiac function and other measures included in the study. Considering the aforementioned definition of fatigue, the decrease in cardiac function of the heart following such a prolonged exercise in this study may be referred to as cardiac fatigue. However, because this analysis utilized a small sample

size, these findings should be interpreted with caution.

Echocardiographic Data

The subjects in this study showed a statistically significant decrease in E:A ratio immediately post-race compared to pre-race measures. This may contribute to the phenomenon of exercise induced cardiac fatigue. The decrease in diastolic function has been confirmed by many researchers (Douglas et al., 1987; Miki,Yokota, Seo & Yokoyama, 1994; Niemela et al., 1987; Rowe, 1993; Seals et al.,1988; Tulloh et al., 2006; Whyte et al., 2000).

An immediate post race decrease in E:A ratio indicates that diastolic filling is compromised and left ventricular compliance is reduced (Whyte et al., 2000). The increased velocity of atrial or late diastolic inflow results in a decrease in early to late diastolic flow velocities as the current study indicates. As diastolic performance depends on many factors such as ventricular loading and contractile conditions, it is difficult to speculate as to a specific cause for this dysfunction (Douglas et al., 1987). Such abnormal filling patterns may be due to reduced ventricular compliance or increased myocardial stiffness. Another possibility for the increased late diastolic filling velocity is simply an increase in the force of left atrial contraction. This results in a higher velocity of blood flow during atrial systole. It should be noted that while transient, it is not known whether this reduction has any impact on subsequent prolonged endurance exercise performance (Whyte et al.).

The current study found a significant decrease in post race stroke volume. Stroke volume is an indicator of systolic performance of the heart and is dependent on two factors: preload on the cardiac muscle and the level of contractility (Guyton & Hall, 2005). Frank-Starling's Law of the Heart simply states that an increase in diastolic filling and pre-load enhances contractility of the heart. As per Starling's mechanism, the force of ventricular contraction is a function of the end diastolic length of the cardiac muscle fibers indicating a close relationship to end diastolic volume (Braunwald et al., 2001; Guyton & Hall). The fractional shortening of myocardial fibers (length of myocardial fibers) is one of the indices of myocardial performance. This is dependent on the preload. Decreased preload because of blood volume redistribution or reduced venous return leads to a reduction in end diastolic volume and subsequent reduced stroke volume (Douglas et al., 1987). In the current study, subjects were exposed to a long duration event as well as high ambient temperatures. Mole and Coulson (1995) note that demands on circulation become exacerbated with an increase in high ambient temperatures. As the increased temperature increases core body temperature, there is a resultant need to redistribute blood flow to the skin as part of the cooling mechanism. Additionally, blood volume and more specifically plasma volume are reduced because of sweating. This subsequently leads to a decreased central blood volume which ultimately reduces cardiac filling allowing for the aforementioned decrease in stroke volume. A fluid shift may affect the contractile and relaxation properties of the myocardium. Therefore, this dysfunction may be attributed to altered cardiovascular loading conditions during prolonged exercise in extreme environments (Middleton et al., 2006). Other factors such as exercise duration, intensity and training status of the subjects contribute to this phenomenon of exercise induced cardiac fatigue (Middleton et al.). Utilizing the equation 220-age for estimating maximal heart rate and noting the average heart rate of the group during the race, it was determined that the subjects raced at an average of 81% of their maximal output.

Studies performed during the Ironman™ Triathlon and other ultra-endurance events support the theory that EICF is duration dependent (Niemela et al., 1987; Niemela et al., 1984; Shave et al., 2002). Additional studies indicate that systolic dysfunction is apparent only after aerobic exercise of greater than six hours duration while shorter duration exercises can produce diastolic dysfunction (Whyte et al., 2000). Moreover, research indicates that time of occurrence is sooner for noncompetitive or untrained healthy subjects (Niemela et al., 1987; Seals et al., 1988). The results of the current study indirectly support the conclusion that EICF seems dependent on the duration of exercise as well as the environmental conditions (Middleton et al., 2007).

It is clear that the etiology of EICF is multi-factorial. With the aforementioned mechanical factors (i.e., loading, contraction) researchers have suggested that elevated plasma free fatty acids and reduced cardiac glycogen subsequent to prolonged exercise can lead to a reduced contractile state of the myocardium (Lucia, Serratosa, Saborido, Pardo, Boraita, Moran, Bandres, Megias & Chicharro, 1999; Niemela et al., 1984). Others report that increased levels of beta natriuretic peptide (BNP) might be a marker of impaired left ventricular performance (Konig et al., 2003). Lastly, it has been hypothesized that left ventricular segmental wall motion abnormalities reduce systolic and diastolic performance of the heart after prolonged exercise (Douglas et al., 1990).

Blood Data

Cardiac isoforms of troponin I (cTnI) and T (cTnT) are highly specific markers of myocardial injury. This study showed moderate increases in levels of cTnI following the race although not statistically significant when compared to clinical norms. One hypothesis that explains this exercise induced myocyte cell disruption is that under the stress of increased oxygen demand by the myocardium there is an increased release of catecholamines. This causes coronary vasospasm and endothelial injury that may result in asymptomatic focal myocardial necrosis resulting in increased troponin levels (Neumayr et al., 2001).

Another explanation to this increase rather than a marker of disruption of contractile proteins, is simply membrane leakage of the cytolytic component of cardiac troponin. This could be because of a transitory increase in membrane permeability. Return of troponin levels after recovery indicates this reversible shift in membrane permeability may be the result of a stress induced overload of free radicals with a resultant production of antioxidants to prevent further myocardial damage (Whyte et al., 2005).

The current study findings of increased levels of cTnI concentrations immediately after the race indicating myocardial injury, are in agreement with several studies (Koller, 2003; Neumayr et al., 2001; Rifai et al., 1999). Based on the YE (Table 1) for each cyclist and their continued participation in bicycle racing, it is surmised that the increase is due to reversibly injured myocytes occurring due to a disruption of cell membranes. The rapid repair mechanisms allow for a prevention of further damage. Because these subjects have experienced this level of athletic stress prior to this study, the myocyte disruption may be part of

the stress-adaption response. Signal influx and efflux through disruptions can initiate changes in gene expression in the disrupted cells and its neighbors promoting long term repair and adaptive responses at both the cellular and tissue level (Koller). Middleton et al. (2007) determined that along with increased cTnI or cTnT following myocardial injury, there is an increase in other cardio-protective proteins such as heat shock proteins. Heat shock proteins aid in myocardial adaptation to EICF and possibly provide future resistance to the damage of ischemia or infarction (Middleton et al.). Lastly, studies have successfully correlated myocyte disruption with depressed ejection fractions and abnormal wall motions on echocardiograpy following extreme endurance efforts (Koller; Tulloh et al., 2006; Whyte et al., 2000). They concluded that abnormal systolic function is a result of combined cardiac fatigue and myocardial cellular disruption.

Conclusions

Within the limitations of this study, the results suggest that intense prolonged endurance exercise in high ambient temperatures does induce cardiac fatigue in competitive healthy cyclists. This is reflected in changes in blood cardiac markers and echocardiographic data. Athletes involved in high level cardiac performance could be exposed to asymptomatic myocyte disruption as they are putting more stress on their hearts by pushing harder and longer than regular associated stresses (Neumayr et al., 2001). Without histological examination to confirm this disruption, it is possible that the increase in cTnI is a normal part of an adaptation process and not of patho-physiological significance. The changes evidenced after such ultraendurance events can provide a trigger for further adaptation allowing cellular and tissue level resistance to future stressful events. It is possible that findings of the current study are normal and part of an adaptation process with no patho-physiological significance. Therefore future research involving endurance athletes should investigate a timeline of cardiovascular examinations (i.e., post-echocardiography, post-cTnI) looking for any evidence of myocardial disruption and subsequent adaptation.

References

Bonetti, A., Tirelli, F., Albertini, R., Monica, C., Monica, M. & Tredici, G. (1996). Serum cardiac troponin-T after repeated endurance exercise events. *International Journal of Sports Medicine, 17(4)*, 259-262.

Braunwald, E., Hauser, S., Fauci, A., Longo, D., Kasper, D. & Jameson, J. (2001). *Harrison's Principles of Internal Medicine, 15th ed*. New York, NY: McGraw Hill Publishers.

Collinson, P., Boa, F., & Gaze, D. (2001). Measurements of cardiac troponins. *Annals of Clinical Biochemistry, 38*, 423-449.

Denvir, M., Galloway, P., Meighan, A., Blyth, M., Alexander, C., Fleming, C. & Frame, F. (1999). Changes in skeletal and cardiac muscle enzymes during the Scottish coast to coast triathlon. *Scottish Medical Journal, 44*, 49-51.

Douglas, P., O'Toole, M., Hiller, W., Hackney, K. & Reichek, N. (1987). Cardiac fatigue after prolonged exercise. *Circulation,76*, 1206-1213.

Douglas, P., O'Toole, M. & Woolard, J. (1990). Regional wall motion abnormalities after prolonged exercise in the normal left ventricle. *Circulation, 82*, 2108-2114.

Goodman, J., McLaughlin, P. & Liu, P. (2001). Left ventricular performance during prolonged exercise: absence of systolic dysfunction. *Clinical Science, 100*, 529-537.

Guyton, A. C. & Hall, J. E. (2005). *Textbook of Medical Physiology, 11th ed*. St. Louis, MO: WB Saunders Publishers.

Koller, A. (2003). Exercise induced increases in cardiac troponins and prothrombotic markers. *Medicine & Science in Sports & Exercise, 35*, 444-448.

Konig, D., Schumaker, Y., Heinrich, L., Schmid, A., Berg, A. & Dickhuth, H. (2003). Myocardial stress after competitive exercise in professional road cyclists. *Medicine & Science in Sports & Exercise, 35(10)*, 1679-1683.

Lucia, A., Serratosa, L., Saborido, A., Pardo, J., Boraita, A., Moran, M., Bandres, F., Megias, A. & Chicharro, J. (1999). Short-term effects of marathon running: No evidence of cardiac dysfunction. *Medicine & Science in Sports & Exercise, 31(10)*, 1414-1421.

Middleton, N., Shave, R., George, K., Whyte, G., Hart, E. & Atkinson, G. (2006). Left ventricular function immediately following prolonged exercise: A meta- Analysis. *Medicine & Science in Sports & Exercise, 38(4)*, 681-687.

Middleton, N., Shave, R., George, K., Whyte, G., Simpson, R., Florida-James, G. & Gaze, D. (2007). Impact of repeated prolonged exercise bouts on cardiac function and biomarkers. *Medicine & Science in Sports & Exercise, 39(1)*, 83-90.

Miki, T., Yokota, Y., Seo, T. & Yokoyama, M. (1994). Echocardiographic Findings in 104 Professional Cyclists with Follow-up Study. *American Heart Journal, 127*, 898-905.

Mole, P. A. & Coulson, R.L. (1995). Symposium: energetics of myocardial function. *Medicine & Science in Sports & Exercise, 17*, 538-545.

Neumayr, G., Pfister, R., Mitterbaurer, A., Gaenzer, H., Sturm, W. & Hoertnagl, H. (2001). Effect of the race across the alps in elite cyclists on plasma cardiac troponins I and T. *American Journal of Cardiology, 89*, 484-486.

Niemela, K., Palatsi, I., Ikaheimo, M., Airaksinen, J. & Takkunen, J. (1987). Impaired left ventricular diastolic function in athletes after utterly strenuous prolonged exercise. *International Journal of Sports Medicine, 8*, 61-65.

Niemela, K., Palatsi, I., Ikaheimo, M., Takkunen, J. & Vuori, J. (1984). Evidence of impaired left ventricular performance after an uninterrupted competitive 24 hour run. *Circulation,70*, 350-356.

Rifai, N., Douglas, P., O'Toole, M., Rimm, E. & Ginsberg, G. (1999). Cardiac troponin-T and I, electrocardiographic wall motion analyses and ejection fractions in athletes participating in the Hawaii Ironman™ triathlon. *American Journal of Cardiology, 83*, 1085-1089.

Rowe, W.J. (1993). Endurance exercise and injury to the heart. *Sports Medicine, 16*, 73-79.

Sagiv, M., Ben-Sira, D., Goldhammer, E. & Soudry, M. (2000). Left ventricular contractility and function at peak aerobic and anaerobic exercises. *Medicine & Science in Sports & Exercise, 32*, 1197-1201.

Schiller, N., Shah, P., Crawford, M., Demaria, A., Devereux, R., Feigenbaum, H., Gutgussel, H., Reichek, N., Sahn, D., Schittger, I, Silverman, N. & Tajik, A. (1989). Recommendations for quantification of the left ventricle by two-dimensional echocardiography. American society of echocardiography committee on standards, subcommittee on quantification of two-dimensional echocardiograms. *Journal of the American Society of Echocardiography, 2*, 358-367.

Seals, D., Rogers, M., Hagberg, J., Yamamoto, C., Cryer, P. & Ehsani, A. (1988). Left ventricular dysfunction after prolonged strenuous exercise in healthy subjects. *American Journal of Cardiology, 61*, 875-879.

Shave, R., Dawson, E., Whyte, G., George, K., Ball, D., Gaze, D. & Collinson, P. (2002). Evidence of exercise-induced cardiac dysfunction and elevated cTnT in separate cohorts competing in an ultra-endurance mountain marathon race. *International Journal of Sports Medicine, 23*, 489-494.

Shave, R., Dawson, E., Whyte, G., George, K., Gaze, D. & Collinson, P. (2004). Altered cardiac function and minimal cardiac damage during prolonged exercise. *Medicine & Science in Sports & Exercise, 369(7)*, 1098-1103.

Starnes, J., Wilson, D. & Erecinska, M. (1985). Substrate dependence of metabolic state and coronary flow in perfused rat heart. *American Journal of Physical Medicine & Rehabilitation, 249*, H799-H806.

Tulloh, L., Robinson, D., Patel, A., Ware, A., Prendergast, C., Sullivan, D. & Pressley, L. (2006). Raised troponin-T and echocardiographic

abnormalities after prolonged strenuous exercise- the Australian Ironman™ triathlon. *British Journal of Sports Medicine,40*, 605-609.

Vanoverschelde, J., Younis, L., Melin, J., Vanbutsele, R., Leclercq, B., Robert, A., Cosyns, J. & Detry, J. (1991). Prolonged exercise induces left ventricular dysfunction in healthy subjects. *Journal of Applied Physiology, 70*, 1356-1363.

Whyte, G., George, K., Sharma, S., Lumley, S., Gates, P., Prasad, K. & McKenna, W. (2000). Cardiac fatigue following prolonged endurance exercise of differing distances. *Medicine & Science in Sports & Exercise, 32(6)*, 1067-1072.

Whyte, G., George, K., Shave, R., Dawson, E., Stephenson, C., Edwards, B., Oxborough, D., Forster, J. & Simpson, R. (2005). Impact of marathon running on cardiac structure and function in recreational runners. *Clinical Science, 108*, 73-80. ■

THE RULES & REVIEW PROCESS

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(c) Each electronic submission must consist of three files: i) cover page including senior author's contact information (*i.e.* name of institution, email, phone number, and mailing address). ii) abstract and manuscript, and iii) tables, charts, and pictures, etc. In addition, one computer CD – (Microsoft Word®) consisting of all three files (*i.e.* i, ii & iii) must be mailed to ICHPER·SD headquarters.

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I. Publication Schedules and Glossary of Terms.

(a) The *JR* spring/summer issue will be published during the month of May/June and the fall/winter issue will be published during the month of November/December.

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International Council for Health, Physical Education, Recreation, Sport, and Dance (ICHPER·SD)

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ISBN #978-0-9821604-6-6 0-9821604-6-1