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RELIABILITY OF THE TEEN RISK SCREEN: A MOVEMENT SKILL SCREENING CHECKLIST FOR TEACHERS

Eileen K. AFRICA[*] & Martin KIDD[**]
**Department of Sport Science, Stellenbosch University, Stellenbosch, Republic of South Africa*
***Centre for Statistical Consultation, Department of Statistics and Actuarial Sciences, Stellenbosch University, Stellenbosch, Republic of South Africa*

ABSTRACT

The importance of fundamental movement skills (FMS) are often taken for granted. It is expected that these movement skills will be adequate to get children through their school career, however, some children struggle. Teachers play an important role, as they are able to observe children in the classroom, as well as in a Physical Education setting. This study aims to provide an easy-to-administer, reliable screening checklist to determine children's FMS. The study sample consisted of 125 girls and seven classroom teachers from a selected school in Stellenbosch, South Africa. The checklist consisted of seven subscales. Cronbach alpha values, confirmatory factor analysis (CFA), partial least squares (PLS) path analyses, Spearman correlations and agreement intra-class correlations (ICC) were calculated. The results indicated that the data supported the reliability of the checklist. Most of the mentioned statistical models fitted the data well. All the scales except one, confirmed an acceptable fit and reliability coefficients reached acceptable values. There is a scarcity of research in this area. Future quality research is vital using validated screening checklists in conjunction with validated movement skill assessment tools.

Key words: Fundamental motor skills; Screening tool; Children; Teachers.

INTRODUCTION

Research involving human growth and motor development has been of insightful importance to researchers and teachers for many years (Gallahue, 1983). During the growing years, children continuously engage in activities involving moving around, handling objects, watching and exploring movement. Pre-adolescence is not only marked by rapid physical change, children also need to perform a repertoire of movement skills during their daily functioning, and developing functional independence is a prerequisite (Sugden & Sugden, 1990; Utley *et al*., 2010).

Fundamental motor skills are seen as building blocks for complex movement patterns. It is imperative that children are exposed to movement skills in various contexts prior to and during the pre-adolescence phase of development (Utley *et al*., 2010). The importance of fundamental movement skills is often taken for granted, as it is seen as a normal part of human development (Cools *et al*., 2008; Auxter *et al.*, 2010). Larkin and Rose (2005)

perceive movement skills as the groundwork of human performance. It is expected that these

movement skills will be adequate to get through the school career with ease, however, some children struggle with some motor skills and are regarded as clumsy or physically awkward (Hay *et al*., 2004). According to Hay *et al*. (2004), these children are faced with a multitude of complications, which up till now have hardly ever received attention.

Over the past three decades, the world has created extremely young technology wizards who engage in sedentary lifestyles (Sanders, 2002). Children with advanced fundamental motor skills are more likely to engage in physical activity, since motor proficiency is inversely related to sedentary lifestyles (Wrotniak *et al*., 2006; Ericsson, 2008; Williams *et al*., 2008; Cliff *et al*., 2009; D'Hondt *et al*., 2011). Developing movement skills is the key line of attack to enhance children's current and future physical activity levels (Morgan *et al.*, 2010). According to Barnett *et al.* (2010), proof regarding the significance of motor skill proficiency in physical activity participation has increased over the last decade. It is thus important to understand fundamental movement skill development to identify problems in order to offer remedial intervention (Piek & Edwards, 1997; Brantner *et al*., 2009). Assessment encompasses a multiplicity of ways to gather information (Auxter *et al.*, 2010). Although the assessment of children's movement skills has noticeably escalated (Netelenbos, 2005), there is a scarcity of research studies in this area (Ward *et al*., 2010). Consequently, future quality research is vital, using validated screening checklists in conjunction with validated movement skill assessment tools (Cliff *et al*., 2009). There are quite a few standardised assessment tools out there, but it is often time consuming, needs qualified professionals, expensive test equipment and adequate space, and children need to be tested individually (Netelenbos, 2005; Schoemaker *et al.*, 2008). Hardly any assessments are administered in schools, because a quick and reliable screening tool that can be used on every child is not available (Ericsson, 2008).

Schools and teachers are increasingly seen as the hub to promote the health and well-being of youth both in the classroom and on the playground (Larkin & Rose, 2005). Schools are the perfect place to receive guidance and support, as most children gather there five days a week. Teachers are interested in the children that they interact with and possess a wealth of information about their development most of the time. Teachers are most likely to be the first to notice that a child struggles with motor skills (Junaid, 2002). They are also supposed to employ an array of techniques to support children in their development (Utley *et al*., 2010). By employing new strategies and using new innovations, teachers can provide better learning opportunities.

This study therefore aims to provide a self-designed, easy-to-administer screening checklist to determine children's fundamental movement skills in a South African school setting. A more fundamental reason for administering the screening checklist in a school setting by Life Orientation (LO) teachers is that screening instruments are usually administered in laboratory settings and usually consists of tasks that are rarely observed in a Physical Education lesson. Researchers often ignore this (Bodnarchuk & Eaton, 2004; Netelenbos, 2005).

PROBLEM STATEMENT

The main problem was to develop a screening tool that is easy for teachers to use in a school setting to identify learners experiencing movement difficulties. The aim of the research was

to construct a teen risk screen that will be thorough, but not daunting, which include multiple items related to fundamental movement skills that enables teachers to identify learners at high risk for movement difficulties.

METHODOLOGY

Participants

The sample consisted of girls (N=125) with a mean age of 12.12 (SD=1.1) years and teachers (N=7) from a selected primary school in the Stellenbosch region, Western Province, South Africa. The teachers were involved and committed to Life Orientation and specifically the Learning Outcome, Physical Development and Movement and/or Physical Education. Inclusion criteria were as follows: The teachers must have been involved in Life Orientation and had to give consent to participate in the study.

Measures

The teachers were trained by the researcher's assistant to administer a 26-item, self-designed motor skills screening checklist (Teen Risk Screen [TRS]), while the children were performing physical activities during a Physical Education lesson. The assistant who trained the teachers was also actively involved in all the measurement processes, thus in effect all the measurements can be viewed as being assessed by the same person. The aim was not to look at inter-rater reliability.

***TABLE 1*: MOTOR SKILLS**

PS-AM	PS-DM	LS-SS	LS-C	MS-SA	MS-MP	MS-GP
Sitting	Body Rolling	Walking	Galloping	Throwing	Carrying	Catching
Standing	Starting #	Running	Sliding	Striking	Dribbling	
Bending	Stopping	Leaping	Skipping	Kicking		
Stretching	Dodging	Jumping				
Twisting	Balancing	Hopping				
Turning						
Swinging						

Starting / take-off

PS-AM = Posture & Stability (Axial Movement);
PS-DM = Posture & Stability (Dynamic Movement); LS-SS = Locomotor Skills (Single Skills);
LS-C = Locomotor Skills (Combinations);
MS-SA = Manipulative Skills (Sending Away);
MS-MP = Manipulative Skills (Maintaining Possession)

There are three fundamental skill categories namely, stability, locomotor and manipulative skills (Wickstrom, 1983). The TRS consisted of seven subscales, namely, posture and stability (axial movement) [PS-AM]; postural stability (dynamic movement) [PS-DM]; locomotor skills (single skills) [LS-SS]; locomotor skills (combinations) [LS-C];

manipulative skills (sending away) [MS-SA]; manipulative skills (maintaining possession) [MS-MP] and manipulative skills (gaining possession) [MS-GP]. The items under each subscale ranged from two to seven items (Table 1).

Each item was rated on a 3-point Likert-type scale (0 = cannot perform skill according to guidelines; 1 = can perform skill but not according to guidelines; 2 = can perform skill). By adding the scores for each item of each skill, a total score can be calculated. The lower the score is, the poorer the motor skill performance. The TRS can be administered to a group of children in a relatively short period of time. A trained administrator can administer the test to a group of 20 children in 30 to 40 minutes.

A reliable instrument is one that is consistent over time, thus it is necessary to ensure that the checklist is valid and reliable. The reliability of the checklist was determined by the test-retest method. An interval of two weeks was used before the second test period. Validity is the extent to which an instrument appears to be measuring what it is supposed to measure (Baumgartner *et al.,* 2002). The type of validity that was addressed in the development of the TRS was content validity, meaning to what extent the instrument will cover the content it intends to cover. The researcher ensured content validity by consulting with four colleagues in the field of Sport Science, as well as trained Physical Education teachers.

Procedure

Informed consent was obtained from the teachers and the principal of the school involved. The teachers attended an information session about the TRS and were educated and skilled to use the checklist. Each teacher received an information booklet in which every motor skill was described in detail. The teachers completed the TRS for each learner during the Physical Education class, while observing them doing a variety of physical activities, for example games and dances.

Statistical analysis

Firstly, Cronbach alpha values were calculated for each of the motor skills to investigate the reliability of items in measuring each of the skills. It is important to note that for the scale, Manipulative skills (gaining possession) [MS-GP], there was only 1 item; therefore it was not included in the statistical analysis. The reliability was then further and more rigorously investigated through confirmatory factor analysis (CFA). Finally partial least squares (PLS) path analyses were conducted that simultaneously evaluated the reliability of the motor skills together with testing the relationship between the first and second measurements. For specific evaluation of test-retest reliability, Pearson correlations as well as agreement intra-class correlations (ICC 2.1) were calculated.

RESULTS

Cronbach's alpha analysis

Table 2 presents the calculated Cronbach alpha values and average inter-item correlations for all the scales. A threshold of alpha>0.7 was used as guideline for acceptable reliability. The results of Test 1 indicated that the screening checklist showed acceptable reliability values ($\alpha \geq 0.70$) in all but 1 of the cases. Scales that might have a problem ($\alpha \leq 0.70$) were

Locomotor Skills – Combinations [LS-C], Manipulative Skills – Sending Away [MS-SA] and Manipulative Skills – Maintaining Possession [MS-MP]. These scales still showed alpha values >0.6. All average inter-item correlations were positive (>0.4) indicating positive correlations structures for all the scales.

***TABLE 2*: CRONBACH'S ALPHA VALUES FOR SIX SCALES AND TWO TIME POINTS**

	Cronbach's Alpha		Average inter-item correlation	
Scales	**Test 1**	**Test 2**	**Test 1**	**Test 2**
PS-AM	0.93	0.86	0.66	0.48
PS-DM	0.89	0.86	0.64	0.56
LS-SS	0.89	0.90	0.66	0.68
LS-C	0.67	0.56	0.42	0.32
MS-SA	0.71	0.45	0.45	0.23
MS-MP	0.62	0.60	0.45	0.43

PS-AM = Posture & Stability (Axial Movement);
PS-DM = Posture & Stability (Dynamic Movement); LS-SS = Locomotor Skills (Single Skills);
LS-C = Locomotor Skills (Combinations);
MS-SA = Manipulative Skills (Sending Away);
MS-MP = Manipulative Skills (Maintaining Possession)

For Test 2, the reliability indices were generally lower than for Test 1, with LS-C, MS-SA and MS-MP presenting lower than acceptable alpha values. MS-MP scores were also lower than the guideline but still on a 0.6 threshold.

Confirmatory factor analysis (CFA)

Due to the sample size not being large enough, separate confirmatory factor analyses (CFA) was fitted for each motor scale, except for LS-C, MS-SA and MS-MP which were combined into 1 model (Table 3). The latter 3 were combined due to the few items measuring each of the scales. The factor analysis (CFA) results were evaluated in 2 steps. Firstly the goodness- of-fit was investigated by reporting root mean square error of approximation (RMSEA) and the adjusted goodness of fit index (AGFI). Guidelines used were RMSEA<0.05 and AGFI>0.95. The second step (if acceptable goodness-of-fit was achieved) was to investigate construct reliability (CR) and variance extracted (VE). Guidelines here were CR>0.7 and VE>0.5.

For the PS-AM and PS-DM Test 1 scales, the CFA results showed marginal fit statistics

with the RMSEA just outside the prescribed boundaries, but the AGFA indices were acceptable. Construct reliability and variance extracted indicated acceptable reliability. However, for Test 2, the fit statistics were well below acceptable. The LS-SS scale gave marginally acceptable RMSEA (Test 1 and 2) and acceptable AGFI, CR and VE (Test 1 and 2). The 3-scale CFA model gave acceptable results for all indices at both time points with perhaps the VE of MS- SA at time Test 2 being slightly lower (VE=0.43).

***TABLE 3*: CONFIRMATORY FACTOR ANALYSIS-FIT STATISTICS**

Model	Test	RMSEA (p-value)**	AGFI	Scales	Construct reliability	Variance extracted
1	1	**0.10 (0.03)**	1.00	PS-AM	0.98	0.85
	2	**0.13 (<0.01)**	0.97		Not reported*	Not reported*
2	1	**0.12 (0.05)**	0.99	PS-DM	0.95	0.80
	2	**0.16 (<0.01)**	0.98		Not reported*	Not reported*
3	1	0.10 (0.13)	1.00	LS-SS	0.97	0.86
	2	0.06 (0.34)	1.00		0.97	0.97
4	1	0.008 (0.74)	0.99	LS-C	0.79	0.57
				MS-SA	0.85	0.65
				MS-P	0.76	0.62
	2	0.05 (0.35)	0.93	LS-C	0.74	0.51
				MS-SA	0.68	0.43
				MS-P	0.79	0.65

*Not reported due to lack of fit
**p-value for test of close fit (RMSEA ≤0.05)

Partial Least Squares path model

The PLS path model simultaneously tested the reliability of the scales (outer model), as well as the relationship between Test 1 and Test 2 (inner model), which provided information on test-retest reliability. Figure 1 shows the layout of this model.

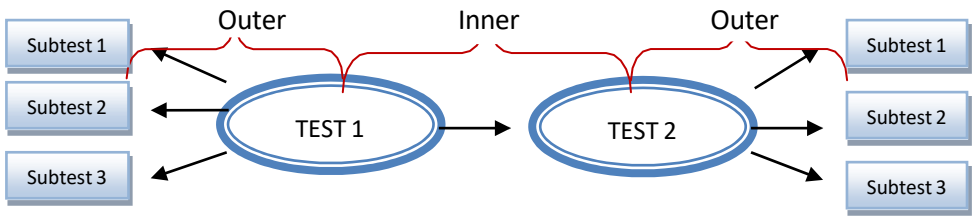

***FIGURE 1*: GENERIC LAYOUT OF PARTIAL LEAST SQUARES PATH MODEL**

***TABLE 4*: PARTIAL LEAST SQUARES PATH MODEL RESULTS**

Scales	Composite reliability		R^2	Variance extracted	
	Test 1	Test 2	Test 1-Test 2	Test 1	Test 2
PS-AM	0.94	0.88	0.34	0.75	0.59
PS-DM	0.92	0.90	0.48	0.71	0.64
LS-SS	0.93	0.93	0.81	0.72	0.74
LS-C	0.82	0.78	0.58	0.61	0.54
MS-SA	0.84	0.73	0.20	0.63	0.48
MS-MP	0.84	0.83	0.35	0.72	0.71

From the results in Table 4, it can be concluded that the composite reliability of all the scales was acceptable (≥0.7). Variance extracted results were similar to the CFA results with all the scales showing VE>0.5 except MS-SA, which were slightly lower (as was the case for CFA). The last column in Table 4 shows the amount of variance of Test 2, explained by Test 1. This can be seen as a measure of test-retest reliability. The LS-SS scale showed the best relationship between test-retest (81%) with the others in varying degrees lower than that. MS- SA gave the lowest R^2 (20%).

Test-retest reliability

***TABLE 5*: RESULTS FOR TEST-RETEST RELIABILITY**

Test 1 & 2 Scales	Pearson correlation	ICC agreement 95% (CI)	Mean ± SD Test 1	Mean ± SD Test 2
PS-AM	0.59	0.51 (0.32, 0.65)	6.9 ± 2.6	7.8 ± 2.1
PS-DM	0.69	0.63 (0.46, 0.75)	10.3 ± 3.4	11.5 ± 2.4
LS-SS	0.88	0.86 (0.76, 0.91)	7.0 ± 2.5	7.5 ± 2.3
LS-C	0.76	0.74 (0.65, 0.82)	4.3 ± 1.5	4.5 ± 1.3
MS-SA	0.43	0.34 (0.13, 0.51)	4.5 ± 1.3	5.2 ± 0.9
MS-MP	0.58	0.56 (0.42, 0.67)	2.9 ± 0.1	3.1 ± 0.9
MS-GP*	0.56	Kappa=0.36(0.21-0.53)		

*Kappa coefficient of conformance is reported here because this scale consists of only one item with Likert outcomes 0.1 and 2. Polychoric correlation is reported which is more suitable for this 3-point Likert scale. No means are reported.

The results (Table 5) revealed significant ($p<0.01$) positive correlations between Test 1 and Test 2. Correlations were relatively high (≥0.7) for all the scales, except for MS-SA (r=0.44) and MS-MP (r=0.59). The ICC values showed a similar pattern with MS-SA lowest (ICC=0.34) and LS-SS highest (ICC=0.86). Repeated measures ANOVA was conducted to test for mean differences between Test 1 and Test 2 and were found to be

significant ($p<0.01$)

in all cases. The averages of Test 2 were always higher. The same trend was seen for MS-GP with a significantly higher proportion of 3's reported in the Test 2 (results not shown). This could be because of a learning/practice or maturation effect. The teachers as the observers could have been more used to administering and understanding the Teen Risk Screen. They were also potentially less nervous during the second testing. The second time around the learners could have had a better understanding of what was expected of them. The children could have become accustomed to the second round of testing, because the excitement of the novelty of the activities diminishes. The children potentially competed against one another, thus performing better.

CONCLUSION

Early testing for problems with fundamental motor skills will ensure adolescents have the capabilities and foundation to grow into adults successfully. As children spend a significant part of the day at school, utilising teachers as testers/observers within the school environment, will ensure that the child acts as intuitively as possible. The results of this study indicated that Posture and Stability - Axial Movement [PS-AM], Posture and Stability - Dynamic Movement [PS-DM] and Locomotor Skills - Single Skills [LS-SS] showed acceptable reliability on all three counts (Cronbach's alpha, CFA and PLS) except for Test 2, where the Confirmatory Factor Analysis [CFA] did not fit for PS-AM and PS-DM. For Locomotor Skills - Combinations [LS-C], Manipulative Skills - Sending Away [MS-SA] and Manipulative Skills - Maintaining Possession [MS-MP] the alphas were generally lower, but acceptable according to the CFA and PLS.

The CFA results did indicate possible problems with PS-AM and PS-DM, and further research should be done on larger samples to investigate possible underlying sub dimensions. However, none of the other statistical procedures (Cronbach alpha & PLS) indicated problems with these scales. Exploratory factor analyses were not done because the aim was to specifically test the current proposed latent structure. It would be useful to conduct such analyses in follow-up studies on larger samples.

The unfortunate reality is that limited data and tests were available to use as a base for determining the reliability coefficient and thus instilling confidence in the Teen Risk Screen. Due to observations from the test process, it is envisioned that more testing and changes to composition of some of the scales in the TRS are required. However, the information gathered can provide valuable addition to measures that teachers use to identify learners with movement difficulties.

Several challenges were met while developing the Teen Risk Screen [TRS]. The teachers that participated in this study were not representative of all teachers involved in Physical Education. When used as a screening tool, it has to be used in juxtaposition with a standardised motor test or clinical assessments.

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Dr. Eileen K. AFRICA: Department of Sport Science, Stellenbosch University, Private Bag X1, Matieland 7602, Stellenbosch, Republic of South Africa. Tel.: +27 (0) 21 808 4591, Fax.: +27 (0) 21 808 4817, E-mail: africa@sun.ac.za

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A COMPARISON BETWEEN CENTRE-BASED AND EXPEDITION-BASED (WILDERNESS) *ADVENTURE EXPERIENTIAL LEARNING* REGARDING GROUP EFFECTIVENESS: A MIXED METHODOLOGY

Gustav GREFFRATH*, Charlé Du P. MEYER*, Herman STRYDOM** & Suria ELLIS***

**Physical Activity, Sport and Recreation, Faculty of Health Science, Potchefstroom Campus, North-West University, Potchefstroom, Republic of South Africa*

***Department of Social Work, Potchefstroom Campus, North-West University, Potchefstroom, Republic of South Africa*

****Department of Statistics, Potchefstroom Campus, North-West University, Potchefstroom, Republic of South Africa*

ABSTRACT

The purpose of this study was to compare the effectiveness of a centre-based adventure program with an expedition-based wilderness program with regard to group effectiveness. For comparisons, this study made use of a crossover experimental design combined with a mixed-method approach. Participants were 28 third-year students (14 men and 14 women), aged 20-23 years (21.6±0.7) of the North-West University. Both quantitative and qualitative instruments were used to gather the data. The results indicated medium (d=0.5) to practically significant (d≥0.8) differences mostly in favour of the centre-based adventure program (communication abilities, productiveness and competition within the group). Only 'group morale' was in favour of the expedition-based wilderness program, which showed a medium effect (d=0.5). A significant sequence effect in favour of first attending the centre-based adventure program and thereafter the expedition-based wilderness program was documented, which led to the conclusion that the two programs should be used in combination. Although both programs were rated very efficient for the improvement of group effectiveness, it is strongly recommended that a centre-based adventure program be used – mainly on account of active involvement, intensive social interaction and continuous group discussions.

Key words: Group effectiveness; Ropes course; Challenge course; Wilderness experience program; Wilderness therapy.

INTRODUCTION

Apart from the popularity and increasing success of adventure experiential learning[(1)], a considerable amount of uncertainly exists regarding the relationship between program components and desired outcomes (Russell, 2000; Russell & Phillips-Miller, 2002; Sibthorp, 2003; Gass & Priest, 2006). What is experienced, is that too much attention is given to **what** participants learn and not **how** learning takes place (Sibthorp *et al.*, 2007; Paisley *et al.*, 2008). The use of adventure experiential learning is mainly centre-based and wilderness- based (Hinkle, 1999; Hans, 2000), and due to this varying use of several adventure activities

and methods (centre-based adventure programs as opposed to expedition-based wilderness programs), Epstein (2004) and Gillis and Gass (2004) hold the opinion that it has led to a pool of confusing outcomes. Any similarities taken into account, Hans (2000) and Pohl *et al.* (2000) are convinced that it cannot be assumed that a centre-based adventure program (CBAP) and an expedition-based wilderness program (EBWP) have the same effect. According to Russell and Phillips-Miller (2002) and Russell and Farnum (2004), more attention should be given to the difference between these two programs. In support of this, Pohl *et al.* (2000) and Yoshino (2005) point out that very few studies focus on the effect of wilderness-based programs compared to other types of adventure programs and that few advantages reaped from adventure experiential learning focus on the effect of the wilderness. In this respect Hui and Cheung (2004) are of the opinion that the design of a specific program for a specific group of participants and the effect thereof are equally important.

Earlier research regarding adventure experiential learning, according to Ewert and McAvoy (2000), are more or less exclusively focused on the individual, but currently a growing interest exists in the advantages it holds for group development. Presently the use of CBAP and of EBWP are known for the development of social abilities (Meyer, 2000; Hui & Cheung, 2004; Dent, 2006), trust, communication, decision making, group dynamics (Ewert & McAvoy, 2000), group cohesion (Glass & Benshoff, 2002; Breunig *et al.,* 2008) and interpersonal skills (Hill, 2007). In an attempt to link program components to program outcomes, Priest (1996) (see Priest, 1998 and Williams, 2000) indicated by way of a comparative study that if group initiatives are more successful than ropes courses, the outcomes can be very valuable for determining which approach needs to be followed for reaching specific program outcomes (organisational trust). With regard to centre-based team- building programs and wilderness expeditions, Greffrath *et al.* (2007), in another comparative study, found that if significant group development is sought, wilderness expeditions should rather be used.

Taking the above-mentioned into consideration, Martin and Leberman (2005) are convinced that if the true meaning of adventure experiential learning is to be understood, one should steer away from using quantitative research methods. To minimise generalisation and to accurately interpret the true meaning of this type of experience, several researchers (Romi & Kohan, 2004; Berman & Davis-Berman, 2005; Martin & Leberman, 2005; Greffrath *et al.,* 2007), recommend that more regular qualitative research be done.

PURPOSE OF THE STUDY

Based on the studies of Priest (1996 & 1998), it therefore was the aim of this study firstly, to determine, by means of a comparative study with a mixed methodology (Hui & Cheung, 2004; Martin & Leberman, 2005; Sibthorp *et al.,* 2007; Sklar *et al.,* 2007; Paisley *et al.,* 2008), the influence of a CBAP as opposed to that of an EBWP regarding group effectiveness. Secondly, the aim was to establish which program components within each program contributed to the development of group effectiveness and thirdly, whether a combination of the two programs could not possibly present the more desired outcome. To reach specific program outcomes regarding group effectiveness, the outcomes of this study could serve as an important indication of the specific approach or procedure that needs to be followed for designing, developing and implementing participation opportunities.

METHOD OF INVESTIGATION

Research design

For purposes of the present study, a crossover research design was used, which consists of a mixed methodology De Vos (2005) refers to as a combination of quantitative and qualitative research in a single study. In a crossover research design all the participants are exposed to both experimental interventions (Simon, 2002), which in this case, are the CBAP and the EBWP. To confirm findings, triangulation was applied which, according to Padgett (2004) and Russell (2006), obtain the confirmation of two or more types of data from, amongst others, interviews, participating observation and documents in writing to investigate the same phenomenon. In this respect the concurrent triangulated strategy of Creswell (2009) was used, in which both quantitative and qualitative data were captured simultaneously and compared to establish whether any similarities, differences or combinations had occurred. The advantage linked to this is that most researchers are familiar with this method and that it often leads to valid and reliable findings.

Investigation population

The total investigation population comprised 28 third-year students (14 men and 14 women) of the North-West University (Potchefstroom Campus) between the ages of 20 and 23 years (21.6±0.7). This group (N=28) was subdivided into two separate groups (n=14) each consisting of 7 men (n=7) and 7 women (n=7). Simon (2002) contends that when using a crossover research design, a control group is not necessary since each group serves as its own control group. Participation in both programs took place on a voluntary basis.

Procedures

Subjects were identified by means of an availability sample and were randomly allotted in advance to the 2 separate experimental groups, which in this case participated in the CBAP and EBWP. The dependent variable, namely group effectiveness, was measured after each program. Coupled with this, focus groups and one-on-one interviews were conducted with each participant after conclusion of each program. All test opportunities took place under the supervision and control of the researcher. To limit the transfer effect to the minimum and to ensure the availability of participants, a period of 5 months (contrary to the 3 and 6 months as recommended by Priest and Lesperance, 1994) was allowed between Test 1 and Test 2, which took place during university holidays in April and September. Both programs were presented in collaboration with "Outward Bound South Africa"[(2)] and "The Teambuilding Institute"[(3)], which were led by professionally qualified facilitators. Regarding the duration of the programs, the CBAP lasted 2 days, whereas the EBWP extended over 7 days. Programs of different duration (as was the case of the 2 groups that participated in both programs) were comparable.

The North-West University (Potchefstroom Campus [NWU-0010-08-S1]) provided ethical approval for the execution of this research project. The parents of the participants were informed of the research project via an information letter along with informed permission and medical and indemnity documents, which were completed by the participants and/or their parents.

Measuring instruments

An adapted group effectiveness questionnaire was used for measuring group effectiveness (Herselman, 1998). It was utilised with a view to establish what effect the CBAP and the EBWP had on group effectiveness and what advantages, if any, each holds for the individual. The questionnaire contained closed-ended questions, regarding group aspects as well as individual aspects, measured on a 5-point Likert scale, to determine the participants' attitudes regarding these variables, after exposure to the CBAP and the EBWP. The participant's views, ideas, feelings or convictions regarding a specific program cannot be measured unless they have participated in/have been exposed to a specific program/intervention. Hence, frequency, means, percentages and standard deviation were only determined after the programs were concluded. Semi-structured one-on-one and focus group interviews (Greeff, 2005), as well as participating observation, were used for the qualitative survey (Strydom, 2005). Due to the multidimensional nature of adventure experiential learning, Epstein (2004) recommends that a variety of research methods be used, which include a combination of quantitative and qualitative approaches. In this respect, Fontana and Frey (2000) contend that qualitative research methods enable the researcher to investigate meticulously, clarify uncertainties and increase the accuracy of feedback.

Data analysis

The quantitative data were analysed statistically with the help of the Statistical Consultation Services at North-West University (Potchefstroom Campus). The data gathered by means of the questionnaire were analysed by using the SAS Institute Inc. (2003) computer program. PROC MIXED in SAS (SAS Institute Inc., 2003), was used to establish whether a sequence and/or period effect had occurred regarding the program and whether differences were found between the participants and the programs. Sequence effects show whether the sequence of participation (e.g. participation in the CBAP first or vice versa), had an effect on the outcome, whilst the period effect indicated whether any seasonal influences (weather conditions, autumn as opposed to spring) had occurred. On account of the specialised nature of the adventure program it was impossible to deal with more than 14 participants per group. It can possibly be too few to ensure enveloping the power of the tests on a 5% significance level; hence, statistical significance was investigated at a 10% significance level. Statistical significance does not necessarily mean the result is important in practice. Practical significance can be understood as a large enough difference to have an effect in practice. A natural way to reflect on the practical significance is to report on the standardised difference between means (effect sizes) (Steyn, 2005). In these results effect sizes of approximately 0.2 are considered small, 0.5 as large enough to be observed, while effect sizes of approximately
0.8 and larger are seen to be practically significant (Cohen, 1988). The qualitative data gathered during the interviews and participating observation were transcribed with the aim of capturing striking and general tendencies. To portray the coherence of the total investigation, these tendencies were categorised into related themes and sub-themes (Tesch, 1990; Poggenpoel, 1998). Interpreting the data-analysis (Tesch, 1990), 2 steps, namely decontextualizing and recontextualizing, were used to analyse qualitative data.

RESULTS

***TABLE 1*: MEAN AND SD OF EVALUATION TESTS**

	Test 1				Test 2			
	Group 1 EBWP (n=14)		Group 2 CBAP (n=14)		Group 1 CBAP (n=14)		Group 2 EBWP (n=13#)	
Component	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1. Problem solving	4.0	0.9	4.5	0.5	4.2	0.7	4.5	0.5
2. Communication ability	3.9	1.0	4.4	0.6	4.4	0.7	4.2	0.6
3. Group cohesion	4.1	0.9	4.3	0.7	4.2	0.7	4.3	0.5
4. Conflict handling	4.1	0.8	3.9	1.0	4.1	0.8	4.4	0.7
5. Competition in the group	2.7	1.3	3.3	0.9	3.7	1.5	2.8	1.1
6. Cooperation between members	4.3	1.1	4.9	0.4	4.4	0.8	4.8	0.4
7. Purposefulness	4.1	0.9	4.7	0.5	4.4	0.9	4.8	0.4
8. Leadership development	4.1	0.7	4.1	0.5	4.4	0.8	4.4	0.7
9. Changes in attitude	3.8	0.6	4.0	0.8	4.1	0.9	4.1	0.5
10. Productivity	4.1	0.8	4.9	0.4	4.6	0.6	4.6	0.5
11. Success experience	4.4	0.5	4.8	0.4	4.5	0.5	4.8	0.4
12. Team spirit	4.7	0.6	4.8	0.4	4.4	0.6	4.8	0.4
13. Decision-making proficiency	3.6	0.8	4.2	0.4	3.7	0.7	4.1	0.5
14. Creativity	4.0	0.8	4.1	0.6	4.1	0.7	4.0	0.4
15. Group morale	4.5	0.5	4.3	0.5	4.3	0.6	4.7	

# One participant in Group 2 (Test 2) withdrew for health reasons
CBAP = Centre-Based Wilderness Program EBWP = Expedition-Based Wilderness Program

The means of evaluation tests (Table 1) gave a clear indication that the CBAP, as well as the EBWP were effective for developing group effectiveness. In most cases a statistically significant participant effect was found, which indicates that different participants gave different responses. There was only a single statistically significant, as well as a medium period effect (leadership development, d=0.50), which indicates that no seasonal effect had occurred. Statistically significant, medium and practically significant sequence effects were observed in problem solving (d=0.65), cooperation between members (d=0.91), purposefulness (d=1.01), productivity (d=0.69), success experienced (d=0.95) and decision-making proficiency (d=0.84). This indicates that subjects who first participated in the CBAP and then in the EBWP gave a visible (d≈0.5) or significantly higher evaluation of both the programs in practice than the participants who first participated in the EBWP and then in the CBAP (Table 2). Statistically, medium and practically significant differences between the two programs were observed in communication ability (d=0.52), competition in the group (d=0.83) and productivity (d=0.68), where evaluation of the CBAP was also visibly (d≈0.5)

to significantly higher in practice than the EBWP (Table 2). Group morale (d=0.58)

evaluation of the EBWP in practice was visibly (d≈0.5) higher than in the CBAP (Table 2).

DISCUSSION

This study attempted firstly, to determine what the difference was in effectiveness between a CBAP and an EBWP for developing group effectiveness. Secondly, the aim was to establish which program components within each program had contributed to group development and thirdly, whether a combination would not perhaps present a more desired outcome. In contrast to the study of Greffrath *et al.* (2007), this study recommends that if significant group development is sought, a CBAP should be used. Coupled with the quantitative data (Table 1 & Table 2), the information gathered through participating observation, one-on-one and focus group interviews (qualitative data) gave strong support for this assumption.

Ninety-six per cent (96%) of the participants indicated that the CBAP should rather be applied for group development. It was clear that the intensive social interaction, active involvement, continuing group discussions and reflection sessions were the most important components of the CBAP, which brought significant change to the fore.

***TABLE 2*: BETWEEN CBAP AND EBWP GROUPS REGARDING EFFECTIVENESS**

	p-Values		
Component	Sequence	Period	Program
1. Problem solving	0.0368*	0.3975	0.6881
2. Communication ability	0.4678	0.3148	0.0641*
3. Group cohesion	0.3702	0.5147	0.8444
4. Conflict handling	0.6695	0.1925	0.1925
5. Competition in the group	0.7211	0.2628	0.0046*
6. Cooperation between members	0.0610*	0.8117	0.4298
7. Purposefulness	0.0573*	0.1448	0.3944
8. Leadership development	0.8714	0.0732*	0.7407
9. Changes in attitude	0.7222	0.2423	0.4467
10. Productivity	0.0240*	0.3877	0.0249*
11. Success experience	0.0052*	0.7589	0.7589
12. Team spirit	0.1375	0.3944	0.1448
13. Decision-making proficiency	0.0227*	0.7951	0.4798
14. Creativity	0.7451	0.9586	0.1693
15. Group morale	0.6271	0.5518	0.0440*

* Significance at a 10% level (p=0.1)
CBAP = Centre-Based Wilderness Program EBWP = Expedition-Based Wilderness Program

According to Glass and Benshoff (2002), programs such as the CBAP present structured group experiences during which the facilitator gives direction and instructions, but at the same

time leaves the responsibility to complete activities successfully to the group. Precisely because of the structured nature of the CBAP, the outcome is much more specific, purposeful and outcome-based regarding group development. Coupled with this, there are more opportunities for group development throughout the entire program.

All deductions are blocked out for a brief period so that the participant can focus on the immediate events. In this respect three of the participants alleged the following:

> *I would say TBI (CBAP) exactly due to the fact that you are ensured that each person will participate in it ... it is the anticipated result and it is purposeful development. You may ask certain questions for which you know there is a need.*

> *The program disclosed it a bit more for me. For instance, the good we did, one can by no means do it on one's own, everything we did was in group context and we had to complete it successfully ... and life is not individual ... one will have to cooperate with people to complete it.*

> *I would say the fact that in the mountains (EBWP) one does not have such a lot of controlled work in the team itself. You know that there are things that go their own way. Where ... at TBI (CBAP) we had a constructive and regulated program. Therefore, everybody was involved all the time. Whereas on the mountain you have ... it (the program) has its own pace at which it progresses and people break away, people leave it, people can no longer. Therefore the group breaks up as you go along.*

Leberman and Martin (2002/2003) mention that a considerable number of sources covering adventure experiential learning indicate that learning takes place easiest when the participant finds himself outside his comfort zone. Contrary to this, Leberman and Martin (2002/2003) found that the most important learning that had taken place was not attributed to this uncomfortable situation (outside one's comfort zone or state of dissonance). Other components of the program were responsible for this, such as purposeful activities, the challenge to function as a group and the reflection linked to it (Leberman & Martin, 2002/2003). Along with this, Zink and Leberman (2001) recommend that facilitators be cautiously mindful of participants' needs and that challenge should not only take place at a physical level. In this respect it was found that the CBAP was markedly more suitable to challenge both the group and the individual in different ways.

> *I think this program (CBAP) depends a lot on your personality, far less than the mountain does I think your personality is stretched far more in TBI, because ... your participation in the group is directly linked to the outcomes. Where, in the mountains (EBWP), if you are an introvert, you can withdraw a bit. But in TBI you do not withdraw.*

The way in which the CBAP challenged the participants at several levels was illustrated by remarks that a different way of thinking should be applied to complete the activities successfully.

> *The activities, you see. Each one makes you think in another way, all the things you have to solve and it brings a little something new to the surface. Then you think a bit differently about other things and so on. It is a bit of a different mind-*

set than you have at this camp (EBWP). It is different to the daily routine. This is what makes it interesting to me.

Yes, because you use an entirely other way of thinking, you see, like me who is always just searching for facts, now I need to apply logic. One uses a completely different part of your brain … I have a creativity of nil … it made me think creatively.

Martin and Leberman (2005) and Paisley *et al.* (2008) found that the most learning that took place could be attributed to the social circumstances in which the participants found themselves. Although these findings were made regarding group behaviour during expedition-based programs, this study found the same during the CBAP. Contrary to expedition-based programs, this study strongly claims that there are many more opportunities for learning in group context during centre-based programs.

For me, it was in the mountains (wilderness), the environment where you were. It played the strongest role at TBI (the centre) the strongest role was the fact that you wish to participate all along. As I said, you are not forced, but you feel you have a definite effect on the group and you also have to play your role.

… everybody was really dedicated to get to the point and later everyone shared their experiences. To me it was … I have never experienced it like this in a group … never … nowhere … at school I was in the hostel. Even among those chaps I did not experience the same group cohesion and team spirit that I experienced during the weekend. To me it was shocking … really. I learned a lot from this weekend.

In support of Glass and Benshoff (2002) and Weilbach (2008), the successful development of group effectiveness took place during the CBAP based on constantly focused group discussions and reflection sessions and on how it is related to the participant's daily life. For this study, this is the most important characteristic that distinguishes a CBAP from the EBWP. Throughout the study the participants accentuated this statement, as portrayed below:

… each activity's talking afterwards one could carry forward to each aspect of one's life. There one could … if one just thought a bit one could really make it applicable to all aspects.

Uhm ... Drakensberg (EGWP) is much harder and it is constantly a challenge, where uhm ... and what I also enjoyed was ... uhm as I said just now, the reflection. Because you did something and then you reflected on it. In the mountains there is no time for reflection, you reflect at the end of the day, you are so tired, you cannot even remember everything that had happened to you.

At TBI (CBAP) … I think growth rather came from the discussion afterwards. Here (EBWP) the discussion was afterwards … it also contributed to it, but it was more … it was not as strong, as good, as at TBI. At TBI an activity would not have done much, to my mind, the discussions did it. But here (EBWP), if one only did the activity (hike), it would already have done the work.

Taking into consideration the above-mentioned and the aim of the study it has been found

with certainty that the nature of the EBWP was more suitable for developing personal

effectiveness. As in the case of the study of Caulkins *et al.* (2006), the majority of participants (96%) of the present study confirmed this statement by mentioning that its unstructured nature, coupled with the isolation the wilderness presents, mainly led to the participants viewing the EBWP to be a program more suitable for personal development.

> *You are not constantly dependent on a group … I think one is more on a survival of yourself … one wants to survive, and one is focused on oneself … uhm … in a lesser degree also on the group but more on yourself.*

> *There was that introspection yes, but it is in no way a continuous thing as in the mountains (EBWP). There was that ... there the whole time you think only of yourself. Here (CBAP) you could only depend on yourself in terms of something*
> *… it is basically just parts of yourself. It is in no way you as a total image.*

Due to the extreme nature of the wilderness environment the participants are forced to function as close social units. Everything a person experiences (e.g. physical climaxes, therapy or personal growth) is experienced in connection with or with the support of others. Challenges such as navigation, preparing food, river crossing, campsite selection, as well as many other things urge cooperation and the effective use of one another's strong points (Kimball & Bacon, 1993). Coupled with this, Breunig *et al*. (2008) found that "sense of place" and the opportunity to break away also contributes to a feeling of intimacy and group cohesion. "Sense of place" is, according to Borrie and Birzell (2001), the value an individual attaches to a place. With reference to the wilderness, Cooley (1998) and Pryor (2003) believe that when someone competes with it, finds his way in it, starts feeling comfortable in it and feels safe, a relationship develops with the "place". In this respect, the opinion of one of the respondents was:

> *... it is the environment that does it to you, that gives you that power, which gives you energy. And then also the environment in terms of the team … because like … to me it actually was cool that we did not get water there on the plateau, because it brought the team members nearer to each other. We knew we sat in a situation that can turn very dangerous. How are we going to handle it? Even when we boiled the water and everything, it is still a risk …we boiled it and everything, but it is still a risk to drink it. As a team as a whole we drank it. It is nearly as if we accepted, if you are going to drink it, I will drink … the same will happen to us all.*

Successful participation during the CBAP can only take place in group context, while the facilitator mainly leads the process of growth. Since the EBWP is less structured, it led to the participants themselves having to take responsibility for their growth process. Due to this, growth was of a more personal nature.

> *... I would say TBI (CBAP) ... the activities are very much directed ... A KA SO (activity) ... focus on that which is important ... the activities are directed at lessons of life, but if you come here (EBWP) it is sort of ... your own lessons of life you teach yourself ... you must initiate that way of thinking yourself ...*

At TBI (Team Building Institute - CBAP) it was ... here the activities and the lesson you learn from the activity and how you will apply it. Here (EBWP) you

have to half ... formulate ... your own lesson of life and decide how you are going to apply it and how to go further.

Earlier on it was mentioned that sequence effects were observed and that subjects who first participated in the CBAP also gave better evaluations of both programs than those who first participated in the EBWP. This tendency is attributed to the transfer effect that took place after conclusion of Test 1. This means that subjects who first participated in the CBAP developed social skills they could build on in the EBWP, whilst those who first participated in the EBWP could only acquire many of these skills later in the CBAP. The sustainability difference between the two programs can be seen in the fact that these variables in Group 2 (problem solving, cooperation between members, purposefulness, productivity, success experience, decision-making proficiency) were more or less the same during both opportunities, whilst it increased in most cases after the CBAP in Group 1 (Table 1). Although the EBWP can be applied successfully for group development, a better effect will be attained in combination with the CBAP. The finding led to the assumption that participation in the CBAP needs to take place prior to exposure to the EBWP. Ninety per cent (90%) of the participants confirmed this finding. To participants with little or no experience of the EBWP, the challenge might be too huge to function in a group. The advantage linked to this is that the CBAP lays the foundation for increasing success and development. This statement is illustrated by two of the respondents:

If we had been at TBI (CBAP) first and then at the wilderness, I think we would have supported each other more and motivated each other more, maybe ... because we had not yet completely learned the skills to be able to do it ...

It is a too extreme environment to throw people who do not know one another into ... immediately it is a survivor type of thing ... you throw the people and they don't know each other at all ... At TBI (CBAP), it is a much more controlled environment ...mush safer ... it is easier, I want to say, to open up yourself ... this (EBWP) ... yes... it is a more dangerous environment and if you do not know the people, do not trust them, the group development will not take place so easily.

CONCLUSION

In contrast to what Greffrath *et al.* (2007) found, the conclusion is made with certainty that if significant group development is sought, a CBAP needs to be used. This finding was made because of a more effective research design (crossover design where all participants were exposed to both programs) with specific emphasis on a mixed methodology. For future comparison studies within the field of experiential learning, this approach cannot be over- accentuated. Active involvement nurtured by means of the activities, intensive social interaction, as well as the focused reflection sessions were the most important program components that led to significant group development. Although it came to the fore that the EBWP was more suitable for personal development, this type of program can be applied with success for group development, provided participation in a CBAP takes place prior to

exposure to the EBWP. Due to the transfer effect, it is recommended, along with Clark *et al.* (2004), that future research focus more on the sustainability of these types of programs.

Coupled with this, the research focus on adventure experiential learning should shift to an approach that is of a more qualitative nature.

In conclusion it needs to be pointed out that the educational value of adventure learning cannot be understood or exposed unless the participant realises the implications thereof in his/her daily life.

NOTES

(1) As methodology, the concept *adventure experiential learning* is often also used in adventure therapy, wilderness therapy (Ewert *et al.,* 2001), therapeutic recreation (Beringer & Martin, 2003) and ropes course programs (Russell, 2001; Hatch & McCarthy, 2006).

(2) See: http://www.outwardbound.co.za

(3) See: http://www.team.co.za

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Dr. Gustav GREFFRATH: Itchyfeet South Africa, P.O. Box 129, Ladysmith 3370 Republic of South Africa. Tel.: +27 0832369010, E-mail: www.itchyfeetsa.co.za

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LOCAL RESIDENTS' PERCEPTIONS OF THE 2010 FIFA WORLD CUP™

Uwe P. HERMANN, Liezel DU PLESSIS, Willie J.L. COETZEE & Susan GELDENHUYS
Department of Tourism Management, Tshwane University of Technology, Pretoria
Republic of South Africa

ABSTRACT

In this country and around the world, the development of the events sector has resulted in a multitude of different types, which are distinguished by factors such as scale, audience and occurrence. The hosting of one such type, mega events, has become a major honour for host cities and countries. The added benefits of hosting events of this scale include the promotion of investment, infrastructure development and a host of other positive economic, social and environmental impacts. This study determined whether there were any significant differences between the pre- and post-perceptions of local residents of the impacts of such a mega event. The 2010 FIFA World Cup and the capital city of South Africa, the Tshwane Metropolitan Municipality, served as a case study. Research was conducted in 2010 and 2011 in nine areas around the city involving a total of 2095 respondents. Descriptive statistics and factor analyses were applied. In general, the respondents perceived the impacts of the event positively; however, this perception dwindled in the period after the event. This study presents future mega event planners and managers with insight into hosting mega events in order to take full advantage of the positive legacy of these events.

Key words: Mega events; 2010 FIFA World Cup; Impact; Host community.

INTRODUCTION

Event tourism has been noted to be one of the fastest growing sectors of the tourism industry (Uysal & Xianping, 2008), which itself is considered as the world"s largest industry (Middleton & Clarke, 2001). Events in South Africa have a long history and many cities today place emphasis on the utilisation of events to market themselves as tourist attractions and destinations (Tassiopoulos, 2005). Events are now part of the marketing and developmental plans of most destinations (Getz, 2007). Destination managers have identified the significance of adding events to enhance their attraction portfolio, which is aimed at providing a level of differentiation in an increasingly competitive tourism market (Dickinson *et al.*, 2007).

The events sector consists of a various sub-sectors. These sub-sectors are differentiated by the type and scale of the events. Events can range from small-scale community events to corporate events and special events such as festivals, fairs and sport events (Getz, 2007).

Mega events are defined as major one-time or recurring events of limited duration that take place at different locations. Mega events have international significance and are typically

organised by a combination of national, international and non-governmental organisations (Roche, 2000; Getz, 2005; Horne & Manzenreiter, 2006; Uppal & Ghosch, 2006). Due to the scale of these events they do not take place on a regular basis, but they are known to take place at least once a year somewhere in the world (Getz, 2005). South Africa has been host to events that fall into this category, including the Rugby World Cup of 1995, the Cricket World Cup of 2003 and, although not on the same scale as the events previously mentioned, the FIFA World Cup of 2010 (WC-2010). These large-scale events are sought after by countries for numerous reasons, the most important of which is to boost their image as tourism destinations (Getz, 2005; Hall & Page, 2009), to promote investment and to gain benefit from the associated positive economic impacts (Briedenhann, 2011). The process of hosting mega events starts off with a bidding process, which is considered by some (Hiller, 2000; Hall, 2006; Torisu, 2006) as a form of urban destination entrepreneurialism as cities and countries seek to gain the maximum advantage from the global economy.

As mentioned above, these large events have a large impact footprint and the beneficiaries of these impacts, the host cities and countries, include a number of resident stakeholders. To date, efforts focused on identifying residents‟ perceptions of the impacts of mega events have been fairly limited (Kim & Petrick, 2003; Lorde *et al*., 2010). Moreover, these studies are usually focused in the sphere of developed countries (Lorde *et al*., 2010) and tend to disregard the circumstances of the developing world. It is important to measure specifically the local residents‟ perception of the event in order to identify the tangible and long-lasting benefits. Event organisers measure the value and success of an event based on the impacts it has on the residents, since they are affected the most before, during and after the event (Chalip, 2006; Bob & Swart, 2009). If residents‟ perceptions are not measured, a phenomenon known as the failure of support for tourism development may occur. This could imply a reluctance to work in the tourism industry and resentment towards tourists could be perceived (Kim & Petrick, 2005). For this reason, the impacts of these events need to be identified and studied from a resident‟s point of view.

Literature on and research into the impacts of these events on host communities in South Africa and on the African continent are limited and fragmented. For this reason, a gap exists for the expansion of research into such events in the region. In order to better understand the potential economic impacts of mega events on host communities, it may be necessary to investigate the available literature in the events sector as applicable to smaller-scale events.

LITERATURE ANALYSIS

For any mega event to be successful, the participation of all stakeholders in the event-organising process is of the utmost importance. This means that local governments, event organisers and policy makers should take into account the views of residents and ensure that those residents support the event (Gursoy & Kendall, 2006; Ntloko & Swart, 2008). This is vital, since hosting of mega events often requires a significant investment in human, physical and economic resources by the host community (Haxton, 1999). The aim of

governments in hosting mega events is not as much the actual event in itself as the proven benefits that the host community will reap after the conclusion of the event (Pellegrino & Hancock, 2007; Rogerson, 2009). These benefits are known as the event legacy and include the opportunity to increase tourism value, branding of the hosting country as a safe tourist destination,

advancing the social legacy of the country by creating employment, equity and growth, urban planning, sport infrastructure, more local business opportunities, renewed community spirit, additional know-how and a positive emotional experience (Roche, 1994; Preuss, 2006; Rogerson, 2009).

***TABLE 1*: POSITIVE IMPACTS OF EVENTS ON LOCAL COMMUNITIES**

Sphere	**Impact**	**Source**
Socio-cultural	Urban revival and production of ideas	Preuss (2006)
	Enhancement of local quality of life through urban regeneration	Ohmann *et al.* (2006)
	Cultural exchange between tourists and local residents	Kim *et al.* (2006)
	Preservation and development of local culture and natural resources	
	Civic pride, community unity and a sense of positive atmosphere	Bull & Lovell (2007)
Economic	Improvement of welfare through increased employment	Preuss (2006)
	Promotion of tourism	Fredline & Faulkner (2000)
	Skills development and cash injections for local businesses	Jago *et al.* (2010)
	Increased public spending for sport	Ntloko & Swart (2008)
	Development of companies and organisations directly or indirectly serving the event	Lamberti *et al.* (2010)
Environmental	Development of new facilities and general infrastructure	Preuss (2006)
	Maintenance and improvement of existing infrastructure	Fredline & Faulkner (2000)
	Restoration of historical buildings	Kim & Petrick (2005)
	Tourism infrastructure development	Malfas *et al.* (2004)
	Large-scale urban development	

Ritchie and Aitken (1984) and Ritchie and Lyons (1987) provide insight into resident perceptions of the Olympic Games of 1984 and 1988, respectively. Both these studies point out that residents in the vicinity of or within the host city where the event was held, perceived the impacts of the event more positively than those residents living further afield. Another study found that resident perceptions of the Olympic Games improved over time,

with the prospect of gaining employment being the main driver (Mihalik & Simonetta, 1998). As opposed to this, a study conducted by Waitt (2003) on the pre- and post-perceptions of the Sydney 2000 Olympic Games found that resident perceptions of the economic impacts of the event declined over time as a consequence of diminishing employment prospects. This is supported by Tin *et al*. (2011), who note that the positive perception of the economic impacts

of the Olympic Games tend to be short-term, principally because of decreasing prospects of employment and the contribution of the event to the GDP. These studies all predominantly focused on economic impacts, whereas social, environmental and political impacts seem to have been neglected. Table 1 provides a generic indication of the impacts of events on host communities.

Although mega events provide numerous positive impacts for a host community, associated negative impacts might also occur. A brief outline of various generic negative impacts is provided in Table 2.

***TABLE 2*: NEGATIVE IMPACTS OF EVENTS ON LOCAL COMMUNITIES**

Sphere	Impact	Source
Socio-cultural	Loss of permanent visitors Creation of temporary tourism	Preuss (2006)
	Increased levels of criminal activity	Ohmann *et al.* (2006)
	Noise, overcrowding and traffic congestion	Fredline & Faulkner (2000)
	Rowdy, poor behaviour and hooliganism	Deery & Jago (2010)
	Vandalism and property damage	Dwyer *et al.* (2000)
	Only some people benefit from the event	Ntloko & Swart (2008)
Economic	High construction costs Construction of non-essential and under-utilised infrastructure	Preuss (2006)
	Creation of temporary employment	Fredline & Faulkner (2000)
	Increased prices due to increased demand	Deery & Jago (2010)
	Waste of taxpayers‟ money	Ntloko & Swart (2008)
	Increased cost of living	Malfas *et al.* (2004)
	Many economic benefits for a few with few benefits for the masses	Desai & Vahed (2010)
Environmental	Litter, overcrowding and parking problems	Fredline & Faulkner (2000)
	Degradation of the environment	Deery & Jago (2010)
	Pollution and damage to natural areas	Ntloko & Swart (2008)

The above literature analysis refers to studies that have been done on to the social, economic and environmental impacts of events in general, as well as the impact of mega

events on host communities. A limited number of studies were found of these impacts in South Africa, the rest of Africa or the developing world as such, and will be discussed to provide insight from a perspective closer to home.

Desai and Vahed (2010) analysed the intricate relationship between host country and the staging of the WC-2010. In their analysis they noted the intrinsic link between the people of

Africa/South Africa and the sport of football and the potential legacy of the event on the country. They mention that parties associated with the event gained significant benefits (usually financial) and that local people were habitually excluded in most cases. This event lacked a „bottom-up" management approach whereby the views and opinions of local residents are incorporated in management decision-making so that the masses too may benefit in the long run.

Meanig and Du Plessis (2007), researched the economic benefits and the financial burden, which resulted from the FIFA World Cup that was held in Germany in 2006. The aim of their work was to identify the lessons that were learned from Germany 2006 in order to provide a context in which the possible benefits and risks for South Africa as a host for WC-2010 were conceptualised. The results from their study showed that occupancy rates in Germany declined during the World Cup and that the construction of new stadiums should be integrated with the needs of the urban society to maximise its benefits. Their paper argues that a public image and the „feel good" effects of sport events are underestimated and should not be neglected when hosting sport events. Pillay and Bass (2008) investigated the association between urban development and the WC-2010 prior to the event. Their research shows that past sport event experiences confirms that there is no proof that the hosting of a mega event will result in a significant contribution to the country"s GDP, meaningful job creation or service, the provision of an infrastructure and facilities that would continue to provide benefits beyond just the duration of the event.

According to Saayman and Rossouw (2008), the potential economic value of the WC-2010 for South Africa was investigated. Computable General Equilibrium (CGE) modelling was used to estimate the potential economic value together with a literature review on past World Cup events. Their findings showed that the WC-2010 was estimated to have possible positive economic impacts in terms of the GDP growth and employment; however, they estimated that negative impacts would arise from higher inflation and net export losses. Alegi and Bolsman (2010) contributed to the academic literature with a scholarly article on the history of soccer in South Africa. Using a collection of different resources to show that football can explain more about South Africa or at least some important aspects of the country. The authors suggested that the WC-2010 would possibly change the perception of the world on South Africa, its diverse people and how South African citizens view themselves and each other.

The above literature paints a picture of the effects of mega events such as World Cups, but do not explain differences between perceptions prior and after the event. Accordingly, it is vital for such a study to be undertaken to make available a platform for the potential future planning and hosting of other mega events. For this reason, the primary aim of this study was to determine whether there were any significant changes in the way in which the local

residents of the Tshwane (Greater Pretoria) Metropolitan Area perceived the impact of mega events on the city after some time had elapsed.

METHODOLOGY

The primary method of data collection was in-person intercept surveys (questionnaires). Data collection was conducted among the residents in April 2010 and again in April 2011. A trained team of 9 fieldworkers (BTech students of the Tshwane University of Technology

[TUT]) and a field coordinator (a lecturer at TUT) administered the surveys in major areas of the host city. Pretoria (in the Tshwane Metro) acted as a host city during WC-2010. This city is the administrative capital city of South Africa (the metro has an estimated population of 2.2 million) and is situated in the Gauteng Province. A number of games were played at the Loftus Versfeld stadium in Pretoria during the tournament.

Research sites

The research sites selected in the city were chosen to guarantee a true representation of the population and demographics of each area. These areas were Centurion, Mamelodi, Laudium, Soshanguve, Ga-Rankuwa, Eersterust, Atteridgeville, Pretoria CBD and Menlyn. If a site had numerous entry and exit points, interviewers rotated and included all possible entries. A stratified random sample of residents by age, gender, area of the city and race was identified. At each location, a random sample of residents were intercepted and requested to complete a questionnaire. Every fifth person or group was targeted and only one adult from each travel party was identified (alternating male and female) and requested to participate at the chosen site. A screening question was put forward to potential respondents to assess if they were residents of the city. If so, they were invited to complete the questionnaire, which took approximately 15 minutes. In the event of respondents not being able to read or write, they requested the field member to complete the responses based on an oral interview. A total of N=2095 responses (961 for 2010 and 1134 for 2011) were obtained. A total of 1200 questionnaires were distributed per year, which resulted in response rates of 80% and 95% respectively for 2010 and 2011.

Research instrument

Fixed-choice self-administered questionnaires were used across all areas of the host city. The questionnaires were divided into sections containing items measuring the demographic profile of residents and contained 40 statements measuring economic, social and environmental aspects (economic aspects are the focus of this paper) on a 5-point Likert scale (1= strongly disagree and 5= strongly agree). Most of the items were measured at nominal or ordinal levels. These types of questions are frequently used in surveys of sport events, such as in the case of Ntloko and Swart (2008). This questionnaire had also been used successfully in 2009 during a survey of host perceptions of the Confederations Cup (Manjule, 2012).

Analysis of data

Microsoft© Excel© was used for data capturing while SPSS (SPSS Inc., 2010) was used for

the analysis of data. This study involved 2 stages. Firstly, a general profile of respondents was compiled. Secondly, 2-way frequency tables and Chi-square tests, as well as ANOVA comparisons were utilised to establish any significant differences between the perceptions of local residents prior to the event and the perceptions of residents after the event. This was deemed possible as the research methodology (questionnaire, locations, and fieldwork) was uniform between the 2 years and the population did not differ vastly. Cross-tabulations with Chi-square tests were furthermore employed to profile these groups demographically.

FINDINGS

This section provides an overview of the profile of the respondents during 2010/2011, and discusses the results of the factor analysis, ANOVA comparisons and cross-tabulations with Chi-square tests.

Profile of respondents

The general profile of the respondents is indicated in Table 3. There were slightly more male respondents during both years of the study. In terms of ethnicity, the respondents were generally representative of the geographical area of the study. In order to achieve a representative ethnic response, surveys were circulated in all major areas of the municipality. The majority of respondents were of African ethnicity, followed by other groups. The majority of respondents were further mainly aged between 20 and 29 years, followed by the age groups 30 to 39 and 16 to 19.

***TABLE 3*: PROFILE OF RESPONDENTS**

Variables	**2010***			**2011***		
Gender	Male: 60.4% (n= 580) Female: 39.6% (n= 381)			Male: 55% (n= 621) Female: 45% (n= 508)		
Ethnic group	African	77.7%	n= 747	African	72.7%	n= 784
	Caucasian	7.8%	n= 75	Caucasian	6.8%	n= 73
	Asian	5.1%	n= 49	Asian	13.4%	n= 144
	Coloured	9.4%	n= 90	Coloured	7.1%	n= 77
Age	16-19 yrs	12.5%	n= 120	16-19 yrs	14.3%	n= 159
	20-29 yrs	44.8%	n= 431	20-29 yrs	37.9%	n= 422
	30-39 yrs	23.5%	n= 226	30-39 yrs	25.5%	n= 284
	40-49 yrs	10.6%	n= 102	40-49 yrs	14.4%	n= 160
	50-59 yrs	6.1%	n= 59	50-59 yrs	5.8%	n= 65
	60+ yrs	2.4%	n= 23	60+ yrs	2.2%	n= 24
Planning to attend or had attended a WC match?	Yes: 58.6% (n= 562) No: 41.4% (n= 397)			Yes: 39.3% (n= 437) No: 60.7% (n= 675)		

*Note that n only represents completed responses and may not represent the entire total.

Respondents were asked whether they were planning on attending a World Cup match

during the event in 2010, and in 2011 they were asked if they had attended a match. Replies to the latter differed noticeably between the 2 years. The majority of respondents indicated that they were planning to attend a match (58.6%) in 2010, but in the following year fewer (only 39.3%) of respondents indicated that they had actually attended a match. This finding may be attributed to respondents blaming the high ticket prices as a reason for not attending. Apart from the previously mentioned finding and an increased participation by Asian respondents in 2011, the general demographic profile of respondents did not fluctuate considerably.

Results of a factor analysis

A factor analysis was conducted on 40 mega event impacts. The matrix of principal axis factor analysis, utilising Oblimin rotation with Kaiser Normalisation, identified 5 motivational factors that were grouped according to common characteristics. All factors had relatively high reliability coefficients with the lowest being 0.534 and the highest being 0.602. All items loaded to a factor had loadings greater than 0.4, and these comparatively high loadings indicated a reasonably high correlation between the factors and their individual items. The Kaiser-Meyer-Olkin measure of sampling adequacy of 0.898 additionally provides an indication that the patterns of correlation are relatively compact and indicates divergent and reliable factors (Field, 2005:197).

The factor scores were determined by averaging all items contributing to a specific factor. These averages originated from a 5-point Likert scale of measurement, where 1 signified
„strongly disagree" and 5 signified „strongly agree". Table 4 indicates the four broad factors identified.

***TABLE 4*: RESULTS OF FACTOR ANALYSIS**

Factors	Factor loading	Mean value	Reliability coefficient
Factor 1: Local community impacts		**3.78**	**0.534**
Incentive to improve preservation of local culture	0.591	3.62	
Improved pride in city of local residents	0.591	3.93	
Factor 2: Local social impacts		**3.03**	**0.562**
Event increased the crime rate	0.637	2.75	0.
Event increased litter in local communities	0.551	2.68	
Event increased prostitution	0.471	2.42	
Factor 3: Local cultural and heritage impacts		**3.58**	**0.602**
Increased efforts for conservation of natural resources	0.595	3.48	
Increased efforts for the restoration of historical buildings	0.576	3.58	
Development of cultural activities by local residents	0.552	3.67	
Factor 4: Global image and tourism		**4.06**	**0.591**
Enhanced South Africa"s image internationally	0.617	4.14	
Improved Africa"s image and decreased Afro-pessimism	0.562	3.82	
Increased number of tourist arrivals	0.542	4.25	

The first factor signified items relating to *local community impacts* (Factor 1), followed by items relating to *local social impacts* (Factor 2), items relating to *local cultural and heritage impacts* (Factor 3) and items relating to *global image and tourism* (Factor 4). The factor with the highest mean value was *global image and tourism* (4.06). The residents therefore perceived this as the most important contribution of the World Cup. Other factors that followed include *local community impacts* (3.78), *local cultural and heritage impacts* (3.58) and lastly *local social impacts* (3.03).

Results of the ANOVA comparison

ANOVA comparisons were applied to establish the differences between the impacts of the WC-2010 between 2010 and 2011, based on the perceptions of local residents. Table 5 indicates the most statistically significant variation between different factors.

***TABLE 5*: COMPARISON BETWEEN PRE- AND POST-EVENT PERCEPTIONS**

Event perceptions		N	Mean	SD	SE	95% Confidence Interval for mean		ANOVA
						Lower	Upper	F-ratio*
Increased investment	2010	961	4.26	0.882	0.028	4.21	4.32	
	2011	1121	3.97	1.089	0.033	3.90	4.03	46.411
Improved public transport	2010	961	3.88	1.106	0.036	3.81	3.95	
	2011	1110	3.66	1.204	0.036	3.59	3.73	18.368
Increased pride in city	2010	961	4.01	1.031	0.033	3.94	4.07	
	2011	1112	3.86	1.065	0.032	3.79	3.92	10.719
Preservation of culture	2010	961	3.73	1.046	0.034	3.66	3.79	
	2011	1106	3.52	1.065	0.032	3.46	3.58	19.631
Increased traffic congestion	2010	961	4.36	0.912	0.029	4.31	4.42	
	2011	1109	3.85	1.166	0.035	3.78	3.91	123.64
Employment creation	2010	961	3.79	1.189	0.038	3.71	3.86	
	2011	1110	3.17	1.334	0.040	3.10	3.25	119.42
Increased Prostitution	2010	961	3.92	1.221	0.039	3.84	4.00	
	2011	1108	3.28	1.293	0.039	3.20	3.36	132.40
Increased crime rate	2010	961	3.62	1.383	0.045	3.53	3.70	
	2011	1118	2.92	1.345	0.040	2.85	3.00	133.34
Creation of new facilities	2010	961	4.01	1.033	0.033	3.94	4.07	
	2011	1123	3.84	1.100	0.033	3.78	3.91	12.178
Increased litter	2010	961	3.61	1.211	0.039	3.53	3.69	
	2011	1111	3.07	1.214	0.036	3.00	3.14	103.79
Increased prices	2010	961	4.17	1.074	0.035	4.11	4.24	
	2011	1112	3.74	1.243	0.037	3.67	3.81	70.769
Increased hooliganism	2010	961	3.56	1.235	0.040	3.48	3.63	
	2011	1117	3.94	1.057	0.032	3.88	4.00	57.601
Sufficient electricity	2010	961	3.45	1.266	0.041	3.37	3.53	
	2011	1118	4.07	1.133	0.034	4.00	4.14	138.82
Increased trade for local businesses	2010	961	3.90	1.021	0.033	3.84	3.97	
	2011	1118	3.59	1.108	0.033	3.53	3.66	44.603

* All F-ratios were significant at p= 0.001

A total of 14 constructs were identified as having a noteworthy periodic change, utilising the ANOVA comparison between 2010 and 2011. These constructs represent various impacts associated with events, which range among economic, social and environmental impacts. Only those aspects that presented a significant difference ($p=<0.05$) are presented in Table 5.

The findings from the ANOVA comparison point towards a general decrease in positive perceptions of the tournament over time. These factors signify both negative and positive

impacts; therefore a decline in perception does not necessarily represent a negative response. Only 3 of the 24 significant factors indicated an increase in 2011 when compared to 2010.

The construct that achieved the highest level of variation between the 2 years was Eskom‟s ability to provide power during the tournament ($F=138.82$, $p=0.001$). Respondents believed that the power utility did supply adequate power during the event; this is a marked increase from the previous year. It should be noted that Eskom did indeed struggle to provide a reliable power supply at the time of the fieldwork.

Increased criminal activity and increased prostitution also signified significant changes. In terms of crime, considerably fewer people believed that crime increased during the period of the event compared to the previous year ($F=133.34$, $p=0.001$). The perceptions of local residents regarding the potential for increased levels of prostitution during the event also improved. Fewer people believed that there had been an increase in prostitution ($F=132.40$, $p=0.001$).

The main findings above present an indication of a general improvement in local residents‟ perceptions. However, there were several factors that indicated a generally negative response. The ability of the event to provide employment obtained decreased support during 2011. Fewer people supported this statement compared to the previous year ($F=119.42$, $p=0.001$). According to the respondents, the event also failed to increase levels of investment with fewer people rating this factor positively during 2011 ($F=46.41$, $p=0.001$).

The three factors that achieved improved ratings during 2011 were power provision (which has already been described), increased hooliganism, and South Africa‟s bid to host a future Olympic event ($F=6.667$, $p=0.01$). Respondents indicated that the South African Police Service implemented sufficient capability to deal with hooliganism during the tournament. Although the respondents generally provided lower ratings for 2011, the possibility of South Africa bidding to host a future Olympic event achieved improved ratings. This factor additionally achieved a high mean score of 4.26. This statement could give an indication of the general sentiment among respondents. Although there were problems with the tournament, the respondents tend to support future mega events.

MANAGERIAL IMPLICATIONS AND CONCLUSION

The main findings of this study indicate that residents of the Tshwane Metropolitan area

had mixed responses to various mega-event impacts. All impacts that were tested showed changes in the way that local residents perceived the WC-2010. The major findings of the study commence with the identification of four main groups of local residents. These four groups are distinguished by the way in which they perceived the mega event. When analysing the findings further, five significant changes in perceptions were encountered. The first indicates that an increased number of local residents believe that Eskom, the national power provider, had met capacity requirements and provided sufficient power during the event. Secondly, although local residents believed that crime would be a problem in 2010, a smaller number of residents felt so in the year after the event. Thirdly, local residents‟ perception that prostitution would increase as a result of the WC-2010 was reduced in the period after the event. Significantly fewer people believed that the event contributed to increased levels of

prostitution. However, the response achieved generally neutral mean scores, which may either indicate that respondents did not relate prostitution to mega events or that there are other factors that relate to increased prostitution. Fourthly, local residents appeared to support the notion that mega events provide increased job opportunities, which supports the finding by Preuss (2006). However, the number of people supporting this belief decreased in the period after the event, which could be attributed to the effects of temporary employment, as noted by Fredline and Faulkner (2000). Lastly, local residents provided a positive perception of the management of the event by the local government and of security enforcement. This is related to the management of safety, litter, traffic congestion and hooliganism.

An assessment of the local residents‟ perceptions of mega events such as the WC-2010 indicates a strong need for greater community involvement in event planning. This is in line with the analysis of Desai and Vahed (2010), who specify that only specified groups of individuals and organisations obtained meaningful benefits from the event and as such these groups strive to promote the positive image of the event‟s legacy. The legacy of the event should, however, also be analysed from the opinions of the ordinary person on the street. These large-scale events have numerous impacts on local communities and their involvement would ensure greater success by providing a platform for improved host and guest relations, as well as relations between the host and the event organising body. It is ultimately the ordinary citizen that will judge the success of a large event such as a FIFA World Cup. This study therefore aspired to promote greater incorporation of local community involvement and a sustainable and holistic management approach when planning future mega events. This would ultimately determine the success of the event, which in due course promotes the long- term survival of the event in the minds and daily lives of local people through a lasting event legacy.

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Mr. Uwe P. HERMANN: Department of Tourism Management, Tshwane University of Technology, Private Bag X680, Pretoria 0001, Republic of South Africa. Tel.: +27 (0)12 382 3528, E-mail: hermannUP@tut.ac.za

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VALIDITY AND RELIABILITY OF THE LEARNING AND PERFORMANCE ORIENTATIONS IN PHYSICAL EDUCATION CLASSES QUESTIONNAIRE: TURKISH SECONDARY SCHOOL STUDENTS

Olcay KIREMITCI
School of Physical Education and Sports, Department of Physical Education and Sports Teaching, Ege University, Izmir, Turkey

ABSTRACT

This study examined the validity and reliability of the Turkish form of the Learning and Performance Orientations in Physical Education Classes Questionnaire (LAPOPECQ), which was developed to determine the students' achievement orientation in Physical Education classes. A total of 292 secondary school students (130 girls, 162 boys) participated in the study. The Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were used to determine the validity of the measurement instrument. In the EFA analysis, the structure with 27 items and five factors was reached as in the original form. The two-step analyses carried out in the scope of the CFA revealed that both the five-factor first order model and the two- factor hierarchical structure are compatible with the data. Coefficients of internal consistency, regarding the sub scales of the scale and the results of the item analysis on the mean differences between the 27% lower and upper groups of the statements making up the scale, indicated that the scale was reliable. The findings show that the LAPOPECQ is a reliable and valid measuring instrument to be used to measure Turkish secondary school students' learning and performance orientation in Physical Education classes.

Key words: Physical Education; Achievement goal; Learning; Performance; LAPOPECQ; Psychometric properties.

INTRODUCTION

The findings of long-term studies have put forward the argument that Physical Education

classes contribute to the development of students in multiple ways, namely cognitive, affective and psychomotor (Barney & Deutsch, 2009). Because of its high potential, the aim of Physical Education is to provide students participating in the classes with positive experiences through physical activities (Liukkonen *et al.,* 2010) and to establish necessary motivation for engagement in physical activities in an active lifestyle (Chatoupis & Emmanuel, 2003; Chen & Ennis, 2004).

Regular participation in sport activities is closely related to issues such as natural ability, achievement, motivational factors and psychosocial development (Smith *et al.,* 2009). It is extremely important to examine the relationship between motivational theories and cognitive, affective and behavioural mechanisms which are thought to develop through Physical Education classes considered as a fun activity (Liukkonen *et al.,* 2010). Therefore, Physical

Education classes have become the focus of important studies in the field of education (Silverman *et al.,* 1998).

Motivation sets the fundamental structure in realising a successful learning experience (Butterworth & Weinstein, 1996). Motivation is considered to be a complex and highly effective factor for individuals in time management, regulating energy, shaping their ideas and desires and putting them into effect and it is also studied as a part of human psychology and behaviour (Urdan & Schoenfelder, 2006).

In the academic literature, one of the most frequently focused research fields concerning student motivation is Achievement Goal Theory studies (Pintrich *et al.,* 2003). Achievement Goal Theory, which is accepted as the most influential approach in modern achievement motivation literature (Elliot, 1999) and is a socio-cognitive structure developed in order to determine the direction of ability evaluations and achievement perception (Nicholls, 1989), aims at determining the intensity of learning orientation of students intended for the goals defined by practices (Stornes *et al.,* 2008). Achievement Goal is defined by Eccles *et al.* (1983) as the common goal of children in learning or in different activities they wish to do. In the framework of this theory, two main types of orientation being "task/learning" and "ego/performance" can be mentioned (Papaioannou, 1994; De Backer & Nelson, 2000; Mattern, 2005; Rogers *et al.,* 2008).

These two different goal perspectives do not exclude each other, despite including significant differences in terms of behaviour (manner). Each student has these different goal orientations at various levels (Shen *et al.,* 2007). Among achievement orientations ego/performance orientation involves outclassing others with little effort, while task orientations involves developing abilities through learning (Treasure & Roberts, 1994; Xiang *et al.,* 2003). Individuals who refer to task orientations when determining their personal goals base their skill development on learning, whereas those referring to ego orientations shape skill development in a result-oriented way (Hoang, 2007; Spittle & Byrne, 2009). In their study, Ames and Archer (1988) state that the learning environment is extremely important when determining task and performance goal orientations. Achievement motivation theoreticians agree that the motivational climate created by other individuals is extremely important for the development of individuals‟ cognitive, affective and behavioural patterns (Papaioannou *et al.,* 2008). Motivational climate implies the

perceptions generated between the students and the teacher and other students toward the goals and aims settled (Stornes *et al.*, 2008).

The motivational climate created in Physical Education classes directly affects students‟ achievement orientations and strategies (Treasure & Roberts, 1995). In the process of education and learning performed within the scope of physical activity, setting the goals with the aim of maximizing the students‟ efforts is a significant responsibility of Physical Education teachers (Papaioannou & Kouli, 1999). However, most of the Physical Education programs currently in practice are extremely poor in terms of equality, giving individual responsibility to students and most importantly in goal setting (Cothran, 2001). Performance- oriented approaches of Physical Education teachers will make the class a practice which values the result to be obtained rather than skill development of students; while task-oriented approaches will make it a social and cooperative practice which features students‟ skill development (Xiang *et al.,* 2003). In other words, developing the motivational climate in

accordance with task orientation will bear more positive results in student development in comparison to performance-oriented practices (Papaioannou, 1994). In addition, the intensive employment of performance-oriented learning strategies currently performed by schools may well cause students to lose motivation in time (Carlton & Winsler, 1998).

The necessity for Physical Education teachers to create a task/learning-oriented motivational climate in their classes has been highlighted (Salvara *et al.,* 2006). In this respect, Physical Education teachers should employ affective strategies and techniques in order to create the necessary motivational climate for students‟ development of skills and learning (Shen *et al.,* 2007). Moreover, academic research on the subject is extremely important to show both theoretically and practically how motivation is oriented in accordance with the goals to be set (Ommundsen & Kvalø, 2007; Shen *et al.,* 2007; Sproule *et al.,* 2007).

Furthermore, achievement goal orientations of students affect their learning conditions and achievement at school (Long *et al.,* 2007). Studies on goal orientation in education are very important as they form a basis for the studies to be carried out in the field of sport and exercise (Rogers *et al.,* 2008). According to Papaioannou and Kouli (1999), the LAPOPECQ measurement instrument may also be used to measure the efficiency of procedural interventions to orient the students‟ current perceptions of the motivational climate as well as to help them assess the motivational climate in Physical Education classes. This measurement instrument may be used to show possible motivational differences in future studies by which individual/competitive and cooperative/goal task orientations will be compared practically. The objective of this study is to examine the reliability and validity of the Learning and Performance Orientations in Physical Education Classes Questionnaire (LAPOPECQ), which was developed by Papaioannou (1994) and has been translated and adapted into different European (Cervelló *et al.,* 2010) and Asian (Sproule *et al.,* 2007) languages, on a Turkish- speaking sample.

METHODOLOGY

Participants

The data used in this study were collected with a simple random sampling method in the 2011 to 2012 academic years. Within the scope of the adaptation, a total of 292 secondary school students whose average age was 14.31±0.92 participated in the practices in this study. Of the total sample, 130 (44.5%) were girls and 162 (55.5%) were boys.

Instrument

The LAPOPECQ, developed by Papaioannou (1994), consists of 5 subscales, which are divided into 2 main scales as performance orientation (Students‟ competitive orientation, Students‟ worries about mistakes, Outcome orientation without effort) and learning orientation (Teacher-initiated learning orientation, Students‟ learning orientation). The LAPOPECQ consists of 27 items of which 5 items are for „competitive orientation‟ and
„worries about mistakes‟ subscales, 4 items for „outcome orientation without effort‟ subscale, 6 items for „teacher-initiated learning orientation‟ subscale and 7 items for „students‟ learning

orientation‟ subscale. The statements are rated on a 5-point Likert-Type scale with the options of 5 for „strongly agree‟ and 1 for „strongly disagree‟.

In the scale development studies carried out on two different sample groups by Papaioannou (1994), the following Cronbach‟s Alpha coefficients of internal consistency were obtained for the first (n=1393) and second (n=394) sample respectively: 0.71 and 0.65 for Students‟ competitive orientation, 0.67 and 0.71 for Students‟ worries about mistakes, 0.65 and 0.64 for Outcome orientation without effort, 0.79 and 0.80 for Teacher-initiated learning orientation and 0.84 and 0.83 for Students‟ learning orientation (Papaioannou, 1994; Papaioannou & Kouli, 1999).

Procedures

In the process of translating the LAPOPECQ into the Turkish language, three linguists and three field experts were consulted. The scale was first translated into Turkish by the linguists, and then by re-translating it into English, it was evaluated in terms of syntax and semantics. Items with their finalised Turkish versions were examined by field experts and checked for expediency and were given their final form. The scale, which was assessed in terms of intelligibility and expediency, was prepared to be applied on students. The study was initiated by taking necessary permissions from the directing boards of schools. In the scope of the study, the responses acquired in line with the subjects‟ opinions about Physical Education classes in which they participated and Physical Education teachers were subjected to reliability and validity analysis.

Analysis

In the scope of the validity and reliability analysis made in the study, in order to estimate the EFA, item analysis and internal consistency coefficients, SPSS 13.0; and the CFA were carried out to determine structural validity where the Lisrel 8.51 package programs were utilised.

RESULTS

Validity of the LAPOPECQ

In order to test the validity of the LAPOPECQ measurement instrument, exploratory and confirmatory factor analyses were carried out.

Exploratory factor analysis

The Kaiser-Meyer-Olkin (KMO) value of the study group was calculated as 0.80. The first findings obtained from factor analysis revealed that factor loadings of the 27 items on the scale ranged between 0.381 and 0.919, and were distributed between 6 factors whose eigenvalues were higher than 1 and which explains 68.13% of the total variance. This shows that analysis results obtained were different from the factor structure of the original scale.

In Figure 1, the first 5 factors have eigenvalues higher that 2, which is clearly higher than the 6th factors‟ eigenvalue. The amount of variance explained by the 6th factor was also

considerably lower than the first 5 factors. Further, it can be concluded that the number of items of 6th factor was not enough to measure. Therefore, exploratory factor analysis was repeated by limiting it to 5 factors as in the factor structure of the original scale.

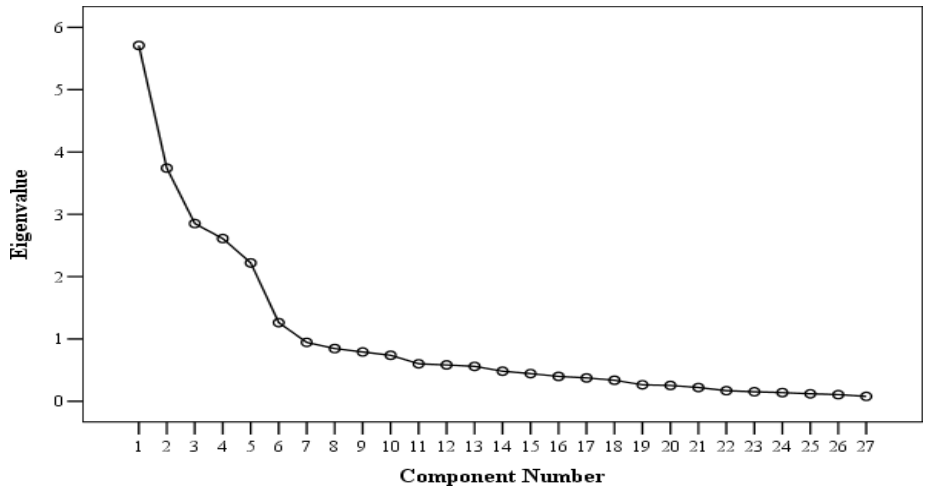

***FIGURE 1*: SCREEN PLOT OF THE LAPOPECQ-tr**

***TABLE 1*: PRINCIPAL COMPONENTS ANALYSIS OF THE LAPOPECQ-tr**

Students' learning orientation	Students' competitive orientation	Students' worries about mistakes	Teacher-initiated learning orientation	Outcome orientation without effort

Item No.	Factor loading	Item No.	Factor loading	Item No.	Factor loading	Item No.	Factor loading	Item No.	Factor loading
14	0.910	**12**	0.923	**10**	0.923	**3**	0.727	**23**	0.874
24	0.901	**20**	0.908	**6**	0.896	**11**	0.718	**7**	0.824
4	0.897	**2**	0.906	**27**	0.863	**13**	0.705	**1**	0.807
18	0.882	**22**	0.876	**9**	0.847	**19**	0.683	**8**	0.754
26	0.592	**25**	0.399	**15**	0.471	**17**	0.678		
16	0.571					**5**	0.590		
21	0.563								
Percentage of variance									
21.14%		13.85%		10.56%		9.67%		8.22%	
Eigenvalue									
5.70		3.74		2.85		2.61		2.22	
Kaiser-Meyer-Olkin measure of sampling adequacy								0.804	
Bartlett's Test		**Approximate Chi-Sq. of hericity**				**df**		**Significance**	
		4941.10				351		0.000	

At the end of the second analysis the Varimax rotation technique was applied and the 5 factors‟ rate of explaining total variance was found to be 63.46%. Moreover, it was observed that the factor loadings of the items making up the scale range between 0.399 and 0.923, and that factor distributions were in compliance with the distribution on the original scale (Table 1).

Confirmatory Factor Analysis

The 5-subscale structure obtained from the Exploratory Factor Analysis (EFA) and the 2-factor hierarchic structure stated in the original scale, were tested by Confirmatory Factor Analysis (CFA) respectively. In the scope of CFA, the first order factor structure consisting of 5 sub-scales was analysed in the first place. Fit indexes of the structure were composed of the sub-scales of Competitive orientation, Worries about mistakes, Outcome orientation without effort, Teacher-initiated learning orientation and Students‟ learning orientation.

***TABLE 2*: FIT INDEXES OF MODEL 1 AND MODEL 2 OF LAPOPECQ-tr**

Model	χ^2	**df**	χ^2**/df**	**RMSEA**	**SRMR**	**NNFI**	**CFI**	**IFI**	**GFI**
Model 1 (First order model)	691.83**	314	2.20	0.064	0.054	0.91	0.92	0.92	0.85
Model 2 (Hierarchical model)	695.42**	318	2.18	0.064	0.056	0.91	0.92	0.92	0.85

**p<0.01 RMSEA= Root Mean Square Error of Approximation SRMR= Standardised Root Mean Square Residual NNFI= Non-Normed Fit Index CFI= Comparative Fit Index IFI= Incremental Fit Index

GFI= Goodness-of-Fit Index

In the fit indexes concerning the first order factor analysis were: chi square value= 691.83; degrees of freedom= 314 (χ^2/df= 2.20) and RMSEA= 0.064, SRMR= 0.054, NNFI= 0.91, CFI= 0.92, IFI= 0.92 and GFI= 0.85. In this hierarchic structure, Chi square value= 695.42 and degrees of freedom= 318 (χ^2/df=2.18). In the fit indexes, RMSEA= 0.064, SRMR= 0.056, NNFI= 0.91, CFI= 0.92, IFI= 0.92 and GFI= 0.85 (Table 2).

At the end of the first order analysis, λ-values of the 27 items ranged between 0.47 and 1.33, δ-values between 0.14 and 0.89, R^2-values between 0.11 and 0.86 and t-values in the range of
5.83 and 20.80 ($p<0.01$). The hierarchic structure formed upon these findings was tested by CFA being a 5 sub-scale structure with performance and learning super scales. Within the scope of hierarchic structure, λ-values of the 5 sub-scales ranged between 0.32 and 0.62, R^2- values between 0.10 and 0.39; and t-values ranged from 3.62 to 4.92 ($p<0.01$) (Table 3).

The amount of variance extracted by factors which were calculated via λ and δ were 0.67 for Teacher-initiated learning orientation, 0.87 for Students‟ competitive orientation, 0.85 for Students‟ worries about mistakes, 0.88 for Outcome orientation without effort and 0.80 for Students‟ learning orientation.

***TABLE 3*: CONFIRMATORY FACTOR ANALYSIS RESULTS OF LAPOPECQ-tr**

First order model (n= 292)	Items	λ	δ	R^2	t
Teacher-initiated learning orientation	**3**	0.97	0.53	0.47	12.01**
	5	0.74	0.73	0.27	8.53**
	11	0.95	0.56	0.44	11.40**
	13	0.93	0.60	0.40	10.80**
	17	0.84	0.64	0.36	10.12**
	19	0.86	0.62	0.38	10.54**
Students‟ competitive orientation	**2**	1.27	0.21	0.80	19.42**
	12	1.30	0.18	0.82	19.85**
	20	1.27	0.20	0.80	19.38**
	22	1.21	0.28	0.72	17.78**
	25	0.47	0.89	0.11	5.63**
Students‟ worries about mistakes	**6**	1.23	0.16	0.84	20.11**
	9	1.04	0.42	0.58	15.11**
	10	1.23	0.18	0.82	19.62**
	15	0.53	0.85	0.15	6.58**
	27	1.19	0.23	0.77	18.72**
Outcome orientation without effort	**1**	1.13	0.39	0.61	15.06**
	7	1.15	0.37	0.63	15.44**
	8	0.90	0.59	0.41	11.52**

		23	1.27	0.21	0.79	18.10**
Students‟ learning orientation		**4**	1.32	0.16	0.84	20.33**
		14	1.31	0.15	0.85	20.55**
		16	0.61	0.81	0.19	7.62**
		18	1.28	0.21	0.79	19.38**
		21	0.60	0.82	0.18	7.49**
		24	1.33	0.14	0.86	20.80**
		26	0.66	0.79	0.21	8.19**
Hierarchical model (n= 292)				**λ**	**R^2**	**t**
Performance	Students‟ competitive orientation			0.32	0.10	3.62**
	Students‟ worries about mistakes			0.46	0.21	4.94**
	Outcome orientation without effort			0.46	0.21	4.73**
Learning	Teacher-initiated learning orientation			0.62	0.39	4.48**
	Students‟ learning orientation			0.35	0.12	3.92**

** p<0.01

Reliability of the LAPOPECQ

In the scope of the reliability analyses of the LAPOPECQ measuring instrument, calculations of internal consistency coefficient and item analyses were carried out on mean differences of the 27% lower and 27% upper groups.

Internal consistency coefficient calculations

In this part of the study, internal consistency coefficients of 5-scale and 2-scale structures obtained at the end of the factor analyses were calculated. In the results obtained, Cronbach‟s Alpha values for the first order sub-scales were calculated as 0.78 for Teacher-initiated learning orientation, 0.88 for Student competitive orientation, 0.87 for Students‟ worries about mistakes, 0.85 for Outcome orientation without effort and 0.89 for Students‟ learning orientation. Cronbach‟s Alpha-values of sub-scales of the 2-factors hierarchic structure were calculated as 0.82 for Performance and 0.83 for Learning (Table 4).

***TABLE 4*: DESCRIPTIVE STATISTICS AND ALPHA COEFFICIENTS FOR THE LAPOPECQ-tr (N=292)**

Model	**Mean**	**SD**	**Skewness**	**Kurtosis**	**Cronbach's Alpha**
Factors: First order model					
Teacher-initiated learning orientation	3.05	0.99	0.336	-0.242	0.78
Students‟ competitive orientation	2.85	1.16	0.335	-0.918	0.88
Students‟ worries about mistakes	3.04	1.11	0.215	-0.987	0.87
Outcome orientation without effort	2.94	1.19	0.302	-0.944	0.85
Students‟ learning orientation	3.07	1.09	0.225	-0.758	0.89

Factors: Hierarchical model					
Performance	2.95	0.77	0.347	-0.527	0.82
Learning	3.06	0.82	0.607	0.071	0.83

In order to calculate factor‟s Cronbach‟s Alpha coefficients of the first order model, all 27 items were recognised. To calculate Cronbach‟s Alpha coefficients of the hierarchical model 14 items were included into the analyses of the Performance sub-scale (Student competitive orientation, Students‟ worries about mistakes, Outcome orientation without effort) and 13 items for Learning sub-scale (Teacher-initiated learning orientation, Students‟ learning orientation).

Item analysis

Within the scope of internal consistency calculations, item analysis was carried out on mean differences of the 27% lower and upper groups (Kelley, 1939). In the analysis concerning at what level the 27 items of the scale can distinguish individuals; the t-test was used for the significance of the mean differences between the lower and upper groups comprising the 27% part. In the results obtained, it can be seen that the t-values of the items ranged between -5.63 and -11.69 and were significant at the level of $p<0.01$ (Table 5).

***TABLE 5*: ITEM ANALYSIS RESULTS FOR LAPOPECQ-tr**

Item No	Lower 27% (n =79)		Upper 27% (n =79)		t
	Mean	SD	Mean	SD	
1	2.17	1.12	3.72	1.39	-7.646**
2	1.97	0.99	3.60	1.39	-8.474**
3	2.37	1.16	3.88	1.19	-7.998**
4	2.13	1.10	4.11	1.08	-11.322**
5	2.58	1.28	3.94	1.21	-6.856**
6	2.15	0.90	3.92	1.15	-10.742**
7	2.31	1.22	3.79	1.36	-7.184**
8	2.54	1.20	3.51	1.40	-4.680**
9	2.31	1.14	3.79	1.28	-7.635**
10	2.07	0.90	3.89	1.22	-10.643**
11	2.64	1.34	4.00	1.21	-6.618**
12	1.96	0.93	3.67	1.37	-9.120**
13	2.65	1.44	3.97	1.20	-6.201**
14	2.24	1.15	4.15	1.06	-10.811**
15	2.45	1.18	3.81	1.32	-6.782**
16	2.43	1.29	4.02	1.10	-8.304**
17	2.43	1.24	3.72	1.33	-6.271**
18	2.31	1.23	4.15	1.06	-10.008**
19	2.56	1.26	3.91	1.17	-6.889**
20	1.88	0.90	3.60	1.40	-9.136**

21	2.59	1.29	3.91	1.25	-6.492**
22	1.98	0.96	3.59	1.38	-8.469**
23	2.27	1.15	3.84	1.27	-8.124**
24	2.12	1.11	4.15	1.06	-11.692**
25	2.30	1.14	3.54	1.40	-6.083**
26	2.51	1.28	4.00	1.18	-7.509**
27	2.06	0.91	3.81	1.19	-10.312**

** p<0.01

DISCUSSION

In this study, it was planned to adapt the LAPOPECQ scale, which was developed by Papaioannou (1994), into Turkish. Reliability and validity analyses were carried out in line with the responses of 292 secondary school students.

The factor distributions of the 27 items, the scale that was developed by the present data, were analysed with the EFA. The KMO-value was found to be 0.804 in order to decide

whether it is appropriate for the given factor analyses. This shows that the data were good in terms of homogeneity (Sharma, 1996). In the item distribution by factors, it was observed that items were distributed in the factors where they belong when it was limited to 5 factors with reference to the original scale.

The 5-factor structure and the 2-factor hierarchic structure were tested by the CFA. It has been seen that the results obtained from the present study were in compliance with the results acquired in the original study (Papaioannou, 1994). According to Chau (1997), the fact that the ratio of Chi square to degrees of freedom was less than 3, reveals that the model complies well with the data. Considering fit indexes, Kelloway (1998), Hu and Bentler (1999), McDonald and Moon-Ho (2002) and Schermelleh-Engel *et al.* (2003) pointed out that RMSEA and SRMR values between 0.05 and 0.08 indicate an acceptable degree of fit. In respect of other fit indexes NNFI, CFI, IFI and GFI values between 0.90 and 0.95 indicate good fit and values between 0.85 and 0.95 are considered to be an indication of acceptable fit (Marsh *et al.*, 1988). In addition, the threshold level of t-values, showing how significantly each variable can be explained by the statements, is 2.576 at p=0.01 significance criteria (Şimşek, 2007). In the fit indexes obtained from the study, it is possible to express that both the first order 5-factor model and the 2-factor hierarchic model comply acceptably with the data (Table 2 & Table 3). The variance extracted values of sub-scales ranged from 0.67 to
0.88. According to Nunnally (1978), the minimum variance extracted values should be 0.50 or larger. These findings show that the 5-factor first order structure and the 2-factor second order hierarchic structure stated in the original scale were valid after exploratory and confirmatory factor analyses.

As for the validity coefficients of the scale, it can be seen that Cronbach‟s Alpha values of the 5 sub-scales range between 0.78 and 0.69; and that among the hierarchic scales the

internal consistency coefficients of Performance and Learning were 0.82 and 0.83, respectively. The fact that Cronbach‟s Alpha-values were 0.70 shows that the sub-scales were appropriate in terms of reliability (Nunnally, 1978). Finally, it was determined that each item had a significant distinctiveness considering the t-values of all items in the item analysis results regarding the 27% lower and upper groups, which was another criterion for validity. The t- values found to be significant show the ability to distinguish (Tavşancıl, 2005). These findings verify and support the factor analysis results.

Statistical analyses applied show that the LAPOPECQ-tr is a measurement instrument that can be used to determine the performance and learning orientations towards Physical Education of secondary school students in Turkey.

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Dr. Olcay KIREMITCI: Ege University, School of Physical Education and Sports, Department of Physical Education and Sports Teaching. Izmir / Turkey. Tel.: +90 232 3425714, Fax.: +90 232 339900, E-mail:olcaykiremitci@gmail.com

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RUNNING A GREENER RACE: WILLINGNESS-TO-PAY EVIDENCE FROM THE OLD MUTUAL TWO OCEANS MARATHON IN SOUTH AFRICA

Waldo KRUGELL* & Melville SAAYMAN**
**School of Economics, North-West University, Potchefstroom Campus, Potchefstroom, Republic of South Africa*
***Tourism Research in Economics, Environ and Society, North-West University, Potchefstroom Campus, Republic of South Africa*

ABSTRACT

Environmentally and socially responsible leisure activity has become a key issue in tourism development. Service providers are keen to promote their environmental sustainability credentials and people are starting to pay for carbon offsets and "green" certified facilities. However, compared to doing business as usual, greener operations often imply large capital investments and higher operating costs. There are numerous studies on the importance of environmentally sustainable tourism, on tourists who indicate that environmental sustainability is important to them and on the positive impacts that it may have on development. This paper aims to make a contribution to the literature on whether people are willing to pay for greener products and services, by extending the scope to the Two Oceans Marathon in Cape Town, South Africa in 2011 where a survey was conducted. The focus was on the characteristics of the runners who were willing to pay for a sustainable event and the results show that there were differences

between the willingness to pay of different groupings of runners. Participants who were older and those who were self-employed were more likely to be greener. Education levels do not seem to matter, but feeling responsible for climate change does.

Key words: Environmental sustainability; Sport events; Two Oceans Marathon; Willingness to pay; Climate change mitigation; South Africa.

INTRODUCTION

Climate change is happening and there exists a unique link between the environment and our leisure activities. Tourism involves travel, which is an important source of greenhouse gas emissions. Although climate change is a significant concern and there is increasing consensus that everyone needs to act together now, it is not always clear that polluters and policy- makers are ready to take the necessary steps to address the challenge. For example, an article in *The Economist* (2011), reported that a proposal to renewably generate 20% of electricity at the Olympic site in London seems to have been abandoned. It is argued that this highlights a broader concern about energy and policy. The development and use of renewable and alternative energy is typically hampered by uncertainty about the future price of energy and the price of carbon, as well as the return on long-term investments. The Olympic Games provided such a longer term and investment was assured, but it seems that early promises

may not be kept. If the suppliers of leisure activities and organisers of major sport and cultural events regard sustainable projects as too expensive, the other side of the coin is that the travelling public may not be willing to pay for a "greener" and more sustainable tourism experience, which is the topic of investigation in this paper.

International academic literature (but there is little in South Africa) exists on aspects of the environment, climate change and tourism. An analysis of the links between tourism and climate change can be grouped into four categories (Fisher, 2007), namely (1) the impact of tourism on climate change, (2) the impact of climate change on tourism, (3) adaptation to climate change, and (4) mitigation of climate change. In this last category, studies of the mitigation of climate change, specifically of willingness to pay, have focused on air travellers‟ willingness to pay for carbon offsets (Brouwer *et al*., 2008), or tourists‟ willingness to contribute to funds for the management and conservation of a particular natural resource (Casey *et al*., 2010).

This paper falls in the last category on mitigation of climate change and takes the question of the environment and climate change to a sport event to ask: Are runners willing to pay for a "greener" marathon? What are the characteristics of these athletes? The Old Mutual Two Oceans Marathon is a major event on the running calendar, and in 2011, it attracted 23 000 participants. Most of the participants fly or drive significant distances to participate and spend a number of days in and around Cape Town as tourists. In order to examine whether the runners are willing to pay to compensate for their carbon footprint in the race, a survey was conducted at the marathon. In total, 502 athletes participated in the survey and data were collected about their demographics, spending and the key question: "Would you be willing to pay more for a more environmentally friendly marathon?" (This question was

answered by 447 runners.) Based on their characteristics, an online carbon calculator shows that the carbon footprint of the average participant is approximately 150kg of CO_2, which can be offset with approximately 1.2 trees (www.trees.co.za).

The paper is organised as follows. Section 2 provides a review of willingness-to-pay studies linked to the mitigation of climate change. Section 3 provides some background to the marathon and a description of the data collected in the survey. Section 4 presents two regression models of the predictors of willingness to pay, and finally the conclusions and recommendations are presented.

LITERATURE REVIEW

Dubois and Ceron (2006) and Patterson *et al*. (2006) provide reviews of the literature on the environment, climate change and tourism. The aim of this brief overview is two-fold: the first is to explain why it is difficult to determine the price of pollution and the value that people place on a sustainable environment; the second is to review the methods that are typically used to determine their willingness to pay and a number of examples from the literature that have applied these methods.

Environment as a common pool resource

Many natural resources are private goods that are rival and excludable in consumption and have clear property rights. Global warming and climate change involve aspects of the natural

environment, which economists refer to as common good characteristics, or non-market resource characteristics. The earth‟s atmosphere and the climate are utilised by all. No one has to pay to live on earth! As a consequence, the environment suffers the effects of negative externalities, specifically the pollution that occurs during all the production and consumption activities. Within the context of this paper, this would, for example, be the pollution that occurs during a flight from Johannesburg to Cape Town to participate in the Two Oceans Marathon. The private cost of the flight to the airline and the individual athlete is clear and represented by the price of the ticket. The CO_2 pollution that occurs during the flight contributes to global warming and climate change and presents a cost to society. The externality is the difference between the private and social costs. The market fails to account for the social costs since no one owns their share of a sustainable environment to sell to polluters and as such no market or price exists. The result is the "tragedy of the commons", whereby the common pool resource is depleted (Black *et al*., 2010). People are all deriving utility from the environment at a rate that is unsustainable.

Are there any solutions? It is not possible to stop tourism or sport events to reduce the related pollution to zero, but there may be solutions in cooperation or coercion (Black *et al*., 2010). Everyone could work together and cooperate to reduce our consumption and the consequent pollution to sustainable levels. This may mean participating only in local marathons and running with recycled socks! This is an unlikely global solution as cooperation will be undermined by the dynamics of the so-called "prisoners‟ dilemma". Everyone will suspect that everyone else will continue consuming and polluting and they will do so themselves. Similarly, a user-pays approach may be possible, but will be limited to voluntary contributions.

Since no one owns the environment, it is not clear to whom payments should be made when polluting. In the case of voluntary purchases of carbon credits, the payments may go towards forestry programmes that capture carbon. The alternative to cooperation is coercion. Government may sell pollution rights if they are able to set carbon caps, measure pollution levels, link it to the polluters and fine those that do not cooperate. Such cap-and-trade systems, along with carbon credits, are already functioning on a limited scale. Along with the creation of a carbon market, government may also levy carbon taxes on polluters. There are also a number of examples, but again it depends on the ability of the government to measure the pollution, link it to the polluters, set the tax rate and enforce it. Both the cap-and-trade system and carbon taxes also suffer from the above cooperation problem, but at a country level. If all governments believe that all the others will allow pollution, they will not create carbon markets or set carbon taxes. The limitations of climate summits attest to this. The biggest polluters are unwilling to agree to carbon limits, or they set low targets. This was again demonstrated at the COP-17 Summit held in Durban in 2011 (Anon, 2011).

Practically speaking, the effects of human activity on the environment, also our tourism activities, will have to be mitigated by a combination of voluntary contributions and compulsory taxes. Tourism research into the mitigation of climate change has focused on tourists‟ willingness to pay for carbon offsets, or tourists‟ willingness to contribute to a fund for the management and conservation of a particular natural resource. The following sub- section provides an overview of recent contributions.

Willingness to pay for climate change mitigation

To determine how much people are willing to pay to mitigate the environmental impact of their travel and tourism activities, three different approaches have been used.

One possibility is the so-called travel cost method. This method is often used to estimate the value of a protected recreational site such as a park or a beach and the impact of changes in access costs or environmental quality. The principle is that the value of a conservation service is reflected in how much individuals are willing to pay to get to the tourist destination. Surveys are used to determine individuals‟ place of residence, the distance to the destination, the frequency of visits and their demographic characteristics. Differences in the number of visits and travel costs are used to determine the willingness to pay for conservation at different sites (King & Mazzotta, 2000). Hakim (2010) provides an example of the use of this method to determine the economic value of parks in Indonesia. Within the South African context, Du Preez *et al*. (2011) applied the travel cost method to estimate a random utility model of the recreational value of beaches in the Nelson Mandela Bay area. This approach is useful when one is interested in a particular area, but it is limited when the concern is with global warming and climate change.

A second approach is the hedonic pricing method. This approach is useful where individuals are already paying an entrance fee and one is interested in identifying the conservation premium associated with a protected recreational site. The approach holds that every tourism experience, such as visiting a park, has a range of characteristics. Some are easy to identify, to determine the cost and set a price, such as the roads or amenities. Other characteristics of the experience, such as the ability to view game in their natural habitat,

are more difficult to quantify, but nevertheless part of the utility that the visitor receives and is willing to pay. With the hedonic pricing method, one does not need to ask visitors how much they are willing to pay. It is possible to observe their spending and use differences in the characteristics of tourism experiences to estimate a conservation premium (King & Mazzotta, 2000). Livengood (1983) used this approach with hunting leases and the demand for wildlife stocks. The approach is useful when one is interested in a particular environmental aspect, but it is limited when the concern is with global warming and climate change.

The third approach is most appropriate when one is interested in people‟s willingness to pay for climate change mitigation and is called the contingent valuation method (CVM). In this approach, respondents in a survey are presented with a scenario about, for example, climate change and asked about their willingness to pay for offsets. The payment is hypothetical and the valuation is contingent on the scenario that is presented. Guidelines for this approach (Arrow *et al*., 1993) are outlined in the Report to the National Oceanic and Atmospheric Administration (NOAA) Panel on Contingent Valuation. The CV methods can employ open- ended questions, dichotomous choices, payment cards or bidding games (Anderson, 2010). Open-ended questions specifically ask respondents how much they are willing to pay for common non-market resources. Dichotomous choice methods include a single value of payment that can either be accepted or rejected by respondents (Anderson, 2010). Where payment cards are used, values of hypothetical payments are printed and respondents are asked how close the values are to the maximum amount that they are willing to pay for non- market resources.

In bidding games, hypothetical payments for common resources can be stacked in ascending or descending order until the respondent rejects or accepts a value (Anderson, 2010). Studies on the willingness to pay for climate change mitigation rely on the assessment of scenarios and therefore the CV methods are used in most cases (Johnson & Nemet, 2010). Examples of such studies include those that take a more general approach to willingness to pay for climate change mitigation, those that consider the carbon footprint of tourism and tourists‟ willingness to pay for carbon offsets, studies that focus specifically on air travel passengers and their CO_2 emissions, and studies that examine tourists‟ willingness to pay for specific environmental goods.

Johnson and Nemet (2010), provide a general review of studies examining willingness to pay for policy on climate, drawing on 27 different surveys conducted between 1998 and 2010. They found a range of willingness to pay estimates across the different studies from $22 to
$437 per household annually, with a median of $135. Common explanatory variables include measures of environmental engagement, environmental attitudes or beliefs, education level, the perceived efficacy of intervention strategies, political views and the level of certainty about climate change and policy outcomes and even the perceptions of others‟ efforts.

McKercher *et al*. (2010) examine the attitudes of Hong Kong residents towards tourism and the environment, and the willingness of these residents to modify their behaviours in response to climate change. The specific objectives of the research were: (1) to identify specific traveller segments based on frequency and destination of travel as a basis to

investigate issues of climate change and travel habits; (2) to identify the level of concerns felt by Hong Kong residents towards climate change; and (3) to identify whether concerns about climate change has caused Hong Kong residents to make voluntary changes to their travel habits. A phone survey was conducted and followed by cluster analysis to identify types of tourists based on their travel propensity, intensity and their style of accommodation. Their results identified four groups: the regular international tourists; active tourists; regional China tourists; and those who are the least travel active. The regular international travellers were most aware of their environmental impact, but also least likely to change their behaviour. Only 23% indicated that they would travel less by plane to reduce their carbon footprint. Approximately 59% indicated that they would prefer to make a voluntary payment rather than pay a mandatory tax.

When the focus is specifically on air travellers‟ willingness-to-pay to offset their CO_2 emissions, there are a number of contributions to the literature. Brouwer *et al.* (2008) surveyed passengers at Amsterdam‟s Schiphol airport and found that the mean willingness to pay was €23 per flight. This willingness to pay is significantly influenced by disposable income, frequency of flying and whether they are taking continental flights (where alternative transport is available). There was also a positive and significant relationship with travellers‟ perceptions of their responsibility for climate change and the effectiveness of the proposed carbon travel tax. Further work by Frew and Winter (2008) examined airlines‟ websites to see how customers are facilitated to buy carbon offsets from their flights. Gossling *et al*. (2007) reviewed industry discourses on tourism and air travel, and Eisenkopf and Knorr (2008) provided a critical assessment of voluntary carbon offsets looking at the voluntary carbon market, the calculation of carbon footprints and the quality of offset projects.

A final example of tourists‟ willingness to pay for specific environmental goods comes from Casey *et al*. (2010), who examined tourists‟ willingness to pay additional fees to protect the coral reefs that they were visiting in Mexico. This payment would be towards a fund to enhance coral reef protection at the Riviera Maya. They surveyed 400 tourists and estimated a probit model of willingness to pay or not. They found willingness-to-pay values that ranged from $42 to $58 and a number of possible predictors of willingness-to-pay. They found that respondents who support direct-use fees are willing to pay slightly more to the coral protection trust.

In summary, it can be said that there is an ever-growing volume of literature that explores the links between the environment, climate change and tourism. There are further contributions that examine the impact of tourism on climate change (Dwyer *et al*., 2010), the impact of climate change on tourism (Pham *et al*., 2010), adaptation to climate change (Claver-Cortez *et al*., 2007) and other that identify environmentally friendly tourists (Dolnicar *et al*., 2008). To the best of our knowledge, no one has taken the questions of the environment, climate change and willingness to pay for mitigation to an event. The following section describes the data collected at the 2011 Two Oceans Marathon and athletes‟ responses to the question: “Would you be willing to pay more for a more environmentally friendly marathon?”

DESCRIPTIVE ANALYSIS

The Old Mutual Two Oceans Marathon is an annual marathon race held in Cape Town in the Western Cape Province of South Africa on the Saturday of Easter Weekend. The first race was held in 1970 and 26 runners participated. Since then, the race has become an institution in the race calendar and a favourite of Capetonians, other South Africans and international athletes. The race comprises an ultra-marathon (56km) and half-marathon (21.1km). The 41st race took place on 23 April 2011. A record number of 23 000 runners lined up for the marathon in 2011, with 14 000 runners competing in the half-marathon and 9 000 in the ultra- marathon.

To examine the characteristics of the athletes and their willingness to pay for a more sustainable marathon, a survey was conducted on 22 April 2011, by means of a structured questionnaire. The questionnaire was developed based on the work of Casey *et al.* (2010). The questionnaire comprised demographic, behavioural and expenditure questions. The runners surveyed were selected on a next-to-pass basis. A total of 502 completed questionnaires (N=502) were used for the purpose of this paper. Of these, 55 skipped the willingness-to-pay question.

The first step in the analysis is to describe the data. Approximately 63% of the respondents in the survey were male, and 35% were female. The ages of the respondents varied between 18 and 69 years, but the average age was 38 years with a standard deviation of 12 years. The majority of these athletes were English-speaking (57%). Approximately 26% said that they were Afrikaans-speaking and the other 14% indicated that they spoke another home language. In terms of education, a quarter of the respondents had a Grade 12 high school qualification; approximately 32% also had a diploma or degree and 23% held a post-graduate qualification. There were 12% of the athletes who had a professional qualification. The occupations match these high levels of education. There were only four professional athletes in the sample. The

majority of the respondents (27%) indicated that they held professional positions, almost 15% were in management and 13% were self-employed. Students, technical and administrative occupations were also significant parts of the occupation demographics. Of the 502 respondents, most (41%) were from the Western Cape Province and 28% were from Gauteng. The third largest group were from KwaZulu-Natal (6.4%), followed by runners from outside South Africa (5.6%). Approximately 35% of the runners indicated that they were local residents and were like "day-trippers" to the race. The rest mainly stayed over with family of friends (18.5%), in a guesthouse or B&B (15.5%) or at hotels (12.7%).

To examine the issue of the environment, climate change and the runners‟ willingness to pay for climate change mitigation, the questionnaire posed the following scenario: Suppose that an additional fee was introduced and added to the race entrance fee to reduce climate change. This fee would contribute to a fund managed by an independent organisation that plants trees to compensate for your contribution to climate change. Taking this into consideration, the respondents were asked to answer the following questions:

1. Would you be willing to pay such a fee in principal to compensate for your contribution to the emission of CO_2 and therefore climate change? (Yes/No)

2. If you are not willing to pay, please indicate why (and they were given 5 possible reasons and an "other" option), and
3. What are the most important reason(s) why you would be willing to pay (and they were given 8 possible reasons and an "other" option)?

Of the 502 respondents, 11% skipped the willingness-to-pay question. Another 27% indicated that they were not willing to pay such an additional fee and 62% said that they would. Respondents who were willing to pay in principle were subsequently asked whether they were willing to pay a specific amount of money. They were reminded to keep their budget constraint in mind and consider the payment relative to the race entrance fee. A start bid of R30 was made and depending on their reply (Yes/No), they were asked for their willingness to pay for a second follow-up bid to which they could again answer either „Yes" or „No". If respondents answered „No" („Yes") to the start bid, the follow-up bid was a lower (higher) amount. This is referred to as a double-bounded (DB) dichotomous choice contingent valuation question and follows the approach of Brouwer *et al*. (2008).

This procedure yields an interval willingness-to-pay value for each individual respondent. One should note that the bid amounts were small – R10, R30 and R50. The cost of offsetting only the CO_2 pollution of a domestic return flight is approximately R90 (www.trees.co.za). This can be seen in comparison with the race fees: South African runners who own a timing chip paid R180 otherwise the fee was R285. The fees for other African entrants and overseas entrants were considerably higher. Approximately 22% of runners indicated that they were willing to pay the R10, 12% were willing to pay R30 and 19% were willing to pay R50. The runners were also asked to name the maximum amount that they were willing to pay over and above the race registration fee. Almost 40% did not answer the question and, for the remaining 60%, the mean amount was R83.

The focus of this paper was not to calculate an aggregate Rand amount for willingness-to-pay, but rather to shed light on which athletes would be willing to pay. Such Rand value estimates (often in the hypothetical millions) depend strongly on the contingency described, bid amounts and characteristics of the sample, provide little insight to organisers of events. Instead, the focus is on the characteristics of those who are willing to pay in order to identify and engage such runners. Table 1 presents cross-tabulations of the willingness-to-pay groupings and according to the gender and age group variables.

***TABLE 1*: CROSS-TABULATION OF WTP AND GENDER AND AGE GROUPS**

Variables			**Willing to pay to mitigate climate change**			
			Skipped	No	Yes	**Total**
Gender	Skipped	Count	**2**	**0**	**5**	**7**
		% within gender	29%	0%	71%	100%
		% WTP	4%	0%	2%	1%
	Male	Count	**35**	**99**	**185**	**319**
		% within gender	11%	31%	58%	100%
		% WTP	64%	73%	59%	64%
	Female	Count	**18**	**36**	**122**	**176**
		% within gender	10%	20%	69%	100%

		% WTP	33%	27%	39%	35%
Age groups	18-30 years	Count	**12**	**31**	**69**	**112**
		% within age gr.	11%	28%	62%	100%
		% WTP	24%	23%	23%	23%
	31-40 years	Count	**17**	**46**	**105**	**168**
		% within age gr.	10%	27%	63%	100%
		% WTP	35%	35%	34%	34%
	41-50 years	Count	**12**	**35**	**91**	**138**
		% within age gr.	9%	25%	66%	100%
		% WTP	24%	26%	30%	28%
	51-60 years	Count	**6**	**17**	**26**	**49**
		% within age gr.	12%	35%	53%	100%
		% WTP	12%	13%	8%	10%
	61 years and older	Count	**2**	**4**	**15**	**21**
		% within age gr.	10%	19%	71%	100%
		% WTP	4%	3%	5%	4%

WTP= Willing To Pay

Table 1 shows that there is a clear gender difference in the willingness to pay for climate change mitigation. Among the men, 58% indicated that they were willing to pay, whereas 31% were not and 11% skipped the question. In comparison, 69% of women said that they were willing to pay, while 20% said that they were not, and 10% skipped the question. Among the different age groups, the runners in the age groups 18 to 30 years, 31 to 40 years and 41 to 50 years (between 62% and 66%) were willing to pay to mitigate their climate change impacts. There was a difference for the group aged 51 to 60 years, where only 53% indicated that they were willing to pay. International studies have found that older people are

more likely to be willing to pay (Johnson & Nemet, 2010). Among the respondents aged 61 years and older, 71% were willing to pay.

Table 2 shows a cross-tabulation of the willingness to pay for climate change mitigation with marital status and home language. There was little variation in willingness to pay between the differences in marital status. A slightly greater percentage of runners who were single or divorced were willing to pay, compared to those who were married. Among the different language groups, a greater percentage of Afrikaans speakers (64%), than English speakers (61%) were willing to pay. Of the runners who indicated that they speak another home language, 65% indicated that they would be willing to pay. Unfortunately, the survey did not distinguish between other indigenous and other foreign languages.

***TABLE 2*: CROSS-TABULATION OF WTP AND MARITAL STATUS AND AGE GROUPS**

Variables			**Willing to pay to mitigate climate change**			
			Skipped	No	Yes	**Total**
Marital status	Skipped	Count	**27**	**2**	**4**	**33**
		% within marital status	82%	6%	12%	100%
		% WTP	49%	1%	1%	7%
	Married	Count	**21**	**82**	**179**	**282**

		% within marital status	7%	29%	63%	100%
		% WTP	38%	61%	57%	56%
	Not married	Count	**6**	**40**	**97**	**143**
		% within marital status	4%	28%	68%	100%
		% WTP	11%	30%	31%	28%
	Divorced	Count	**1**	**7**	**18**	**26**
		% within marital status	4%	27%	69%	100%
		% WTP	2%	5%	6%	5%
	Widow/er	Count	**0**	**0**	**3**	**3**
		% within marital status	0%	0%	100%	100%
		% WTP	0%	0%	1%	1%
	Living together	Count	**0**	**4**	**11**	**15**
		% within marital status	0%	27%	73%	100%
		% WTP	0%	3%	4%	3%
Home language	Skipped	Count	**1**	**1**	**1**	**3**
		% within language	33%	33%	33%	100%
		% WTP	2%	1%	0%	1%
	Afrikaans	Count	**12**	**37**	**86**	**135**
		% within language	9%	27%	64%	100%
		% WTP	22%	27%	28%	27%
	English	Count	**32**	**81**	**177**	**290**
		% within language	11%	28%	61%	100%
		% WTP	58%	60%	57%	58%
	Other	Count	**10**	**16**	**48**	**74**
		% within language	14%	22%	65%	100%
		% WTP	18%	12%	15%	15%

Table 3 presents a cross-tabulation of willingness to pay and education levels. The review by Johnson and Nemet (2010) shows that education levels have been found as a significant determinant of willingness to pay for mitigation change. The marathon sample also indicated

differences. Table 3 shows that 50% of the runners who indicated that they have no schooling also indicated that they were willing to pay for climate change mitigation. Of those with a matric/Grade 12-level qualification, 59% were willing to pay. More of the athletes who had a degree or diploma (69%) or post-graduate qualification (66%) were willing to pay. A proportions test shows that the differences between the respondents that were willing to pay and those that were not are significant. Within the group that were willing to pay the differences between the different education groups were not significant at the 5% level. Interestingly, only 55% of those with professional qualifications were willing to pay to mitigate their impact on the environment. Further cross-tabulations showed that these professionals were mostly males, married and English-speaking. They were from the Gauteng and Western Cape Provinces and on average had the highest total spending at the race. It is possible that they may be able to pay, but were not willing to since they feel they were already incurring substantial expenses.

***TABLE 3*: CROSS-TABULATION OF WTP AND LEVEL OF EDUCATION**

Variables			**Willing to pay to mitigate climate change**			**Total**
			Skipped	No	Yes	
Level of	Skipped	Count	**8**	**4**	**5**	**17**

education		% within education	47%	24%	29%	100%
		% WTP	15%	3%	2%	3%
	No schooling	Count	**4**	**1**	**5**	**10**
		% within education	40%	10%	50%	100%
		% WTP	7%	1%	2%	2%
	Matric	Count	**13**	**37**	**71**	**121**
		% within education	11%	31%	59%	100%
		% WTP	24%	27%	23%	24%
	Diploma/ degree	Count	**9**	**42**	**112**	**163**
		% within education	6%	26%	69%	100%
		% WTP	16%	31%	36%	32%
	Post-graduate	Count	**11**	**30**	**78**	**119**
		% within education	9%	25%	66%	100%
		% WTP	20%	22%	25%	24%
	Professional	Count	**9**	**20**	**36**	**65**
		% within education	14%	31%	55%	100%
		% WTP	16%	15%	12%	13%
	Other	Count	1	1	5	7
		% within education	14%	14%	71%	100%
		% WTP	2%	1%	2%	1%

In Table 4, the willingness to pay and occupation groups are cross-tabulated. The percentage of runners who were willing to pay to mitigate their impact on the environment were 64% for students, 63% for educators, 62% for professionals, 62% for those in administration, 61% for those in sales and 60% for managers. Notable differences that showed up were with the percentages of civil servants (54%) and pensioners (45%) who were willing to pay compared to the aforementioned groups. On the other side of the distribution, 72% of the self-employed

runners were willing to contribute. Three out of the 4 professional athletes were willing to pay.

***TABLE 4*: CROSS-TABULATION OF WTP AND OCCUPATION**

Variables			**Willing to pay to mitigate climate change**			**Total**
			Skipped	No	Yes	
Occupation (Occup.)	Skipped	Count	**4**	**1**	**4**	**9**
		% within occup.	44%	11%	44%	100%
		% WTP	7%	1%	1%	2%
	Professional	Count	**11**	**44**	**83**	**138**
		% within occup.	8%	32%	60%	100%
		% WTP	20%	33%	27%	27%
	Management	Count	**8**	**20**	**46**	**74**
		% within occup.	11%	27%	62%	100%
		% WTP	15%	15%	15%	15%
	Self-employed	Count	**7**	**11**	**47**	**65**
		% within occup.	11%	17%	72%	100%
		% WTP	13%	8%	15%	13%

	Technical	Count	**3**	**9**	**26**	**38**
		% within occup.	8%	24%	68%	100%
		% WTP	5%	7%	8%	8%
	Sales	Count	**5**	**4**	**14**	**23**
		% within occup.	22%	17%	61%	100%
		% WTP	9%	3%	4%	5%
	Administrative	Count	**3**	**10**	**21**	**34**
		% within occup.	9%	29%	62%	100%
		% WTP	5%	7%	7%	7%
	Civil service	Count	**1**	**5**	**7**	**13**
		% within occup.	8%	38%	54%	100%
		% WTP	2%	4%	2%	3%
	Education	Count	**3**	**4**	**12**	**19**
		% within occup.	16%	21%	63%	100%
		% WTP	5%	3%	4%	4%
	Professional athlete	Count	**1**	**0**	**3**	**4**
		% within occup.	25%	0%	75%	100%
		% WTP	2%	0%	1%	1%
	Pensioner	Count	**3**	**3**	**5**	**11**
		% within occup.	27%	27%	45%	100%
		% WTP	5%	2%	2%	2%
	Student	Count	**2**	**11**	**23**	**36**
		% within occup.	6%	31%	64%	100%
		% WTP	4%	8%	7%	7%
	Unemployed	Count	**3**	**4**	**6**	**13**
		% within occup.	23%	31%	46%	100%
		% WTP	5%	3%	2%	3%
	Other	Count	**1**	**9**	**15**	**25**
		% within occup.	4%	36%	60%	100%
		% WTP	2%	7%	5%	5%

The final cross-tabulation in Table 5 shows willingness to pay and the runners‟ province of residence. The province of residence is a proxy for the athletes‟ carbon footprint for the marathon. Those who live outside of Cape Town have to travel further and that increases their private and also social costs. Whether these participants take cognisance of their location and associated travel behaviour in their willingness to pay is not clear. It seems that those who travelled further may be more cost sensitive and less likely to make a contribution to mitigation of their emissions.

***TABLE 5*: CROSS-TABULATION OF WTP AND PROVINCE OF RESIDENCE**

Variables			**Willing to pay to mitigate climate change**			
			Skipped	No	Yes	**Total**
Province of residence	Skipped	Count	**3**	**0**	**3**	**6**
		% within province	50%	0%	50%	100%
		% WTP	5%	0%	1%	1%
	Western Cape	Count	**21**	**61**	**126**	**208**
		% within province	10%	29%	61%	100%
		% WTP	38%	45%	40%	41%
	Gauteng	Count	**10**	**41**	**93**	**144**
		% within province	7%	28%	65%	100%

		% WTP	18%	30%	30%	29%
	Eastern Cape	Count	**2**	**3**	**16**	**21**
		% within province	10%	14%	76%	100%
		% WTP	4%	2%	5%	4%
	Free State	Count	**2**	**8**	**11**	**21**
		% within province	10%	38%	52%	100%
		% WTP	4%	6%	4%	4%
	KwaZulu-Natal	Count	4	6	22	32
		% within province	13%	19%	69%	100%
		% WTP	7%	4%	7%	6%
	Mpumalanga	Count	**5**	**1**	**6**	**12**
		% within province	42%	8%	50%	100%
		% WTP	9%	1%	2%	2%
	Northern Cape	Count	**0**	**1**	**3**	**4**
		% within province	0%	25%	75%	100%
		% WTP	0%	1%	1%	1%
	North West	Count	**2**	**2**	**8**	**12**
		% within province	17%	17%	67%	100%
		% WTP	4%	1%	3%	2%
	Limpopo	Count	**2**	**5**	**7**	**14**
		% within province	14%	36%	50%	100%
		% WTP	4%	4%	2%	3%
	Outside SA	Count	**4**	**7**	**17**	**28**
		% within province	14%	25%	61%	100%
		% WTP	7%	5%	5%	6%

The provinces with the greatest proportions of runners who were willing to pay include the Eastern Cape (76%) and Northern Cape (75%). A middle group of provinces with participants who were willing to pay include Gauteng (65%), KwaZulu-Natal (69%) and the North West Province (67%). Of the participants from the Western Cape, who are closest to Cape Town, 61% were willing to pay for climate change mitigation. The provinces with the lower proportions of runners who were willing to pay were the Free State (52%), Mpumalanga (50%) and Limpopo (50%).

A cross-tabulation of province and total spending showed that total spending of athletes from the Free State and Mpumalanga, were less than that of the average participant, which may be linked to incomes. Those from Limpopo spent much more than average, which may be linked to distance and travel cost. Of the runners from outside South Africa, 61% were willing to pay.

The questionnaire also asked the participants who were willing to pay, why they would be willing to pay the additional fee. The reasons cited most were that they felt responsible for climate change and that they care about the environment in general. Protecting fauna and flora and giving money for good causes featured as secondary reasons. Similarly, the runners who were not willing to pay were asked why that was the case. The main reason given for not being willing to pay was that people believed that the mitigation programme will have no real impact. This was followed by reasons such as having too little income and

not believing in climate change.

Finally, it is also possible to examine the runners‟ total spending during the Two Oceans Marathon per willingness to pay category and the differences were small. The average of total spending of those who are willing to pay was R4148, and for those who were not willing to pay, it was R4447. The spending of those who were not willing to pay also showed greater variation. Building on this description, the following section presents the empirical analysis of the predictors of which tourists are willing to pay more for a sustainable event.

REGRESSION ANALYSIS

The empirical analysis involved the estimation of an ordered probit regressions model of the predictors of willingness to pay. Willingness to pay was modelled as a function of characteristics of Two Oceans Marathon participants. These explanatory variables include: gender (males=0), marital status (married=0), language (Afrikaans=0), education (no schooling=0), occupation (professionals=0), province that the runner is from (outside SA=0), number of nights spent in Cape Town, the type of accommodation used (local resident=0), age, total spending during the marathon weekend and a number of reasons why they were willing or not willing to pay.

Table 6 shows the results from the ordered probit regression. The willingness-to-pay dependent variable is seen as a rank of categories: those who are not willing to pay and those who are willing to pay R10, R30 and R50. Independent variables with positive coefficients are associated with increased willingness to pay. Table 6 also shows the results for the gender, marital status, home language, education and occupation variables. Standard errors are in brackets. Compared to males, females were willing to pay.

Compared to married respondents, those who are not married were willing to pay more and this effect was significant at the 5% level. None of the education groupings yielded significant coefficients, but it is interesting to note that, compared to those with no education, the other categories were not willing to pay. Compared to professionals, those who were self- employed (5% level of significance) and those in administrative positions (5% level of significance) and students (10% level of significance) were willing to pay.

***TABLE 6*: REGRESSION RESULTS FOR DEMOGRAPHIC VARIABLES**

Variable	**Ordered probit (SE)#**	**Variable**	**Ordered probit (SE)#**
Gender		*Occupation:*	
Female	0.229 (-0.144)		0.405 (0.204)**

Marital status		Management	0.889 (0.232)**
Not married	0.387 (0.167)**	Self-employed	0.399 (-0.276)
Divorced	0.271 (-0.265)	Technical	0.610 (0.352)*
Widow/er	-1.343 (-1.108)	Sales	0.612 (0.308)**
Living together	-0.147 (-0.390)	Administrative	0.507 (-0.440)
Home language		Civil service	0.132 (-0.338)
English	-0.08 (-0.147)	Educator	-0.591 (-0.659)
Foreign language	0.190 (-0.228)	Professional athlete	-0.093 (-0.459)
Education		Pensioner	0.348 (-0.290) *
Matric	-0.356 (-0.524)	Student	-1.186 (0.614)
Diploma/degree	-0.078 (-0.519)	Unemployed	
Post-graduate	-0.082 (-0.529)		
Professional	-0.098 (-0.548)		

SE = Standard Error ** 5% level of significance * 10% level of significance

***TABLE 7*: REGRESSION RESULTS FOR LOCATION, AGE, SPENDING AND ATTITUDE VARIABLES**

Variables	Ordered probit (SE)	Variables	Ordered probit (SE)
Accommodation		*Province*	
Family or friends	-0.221 (-0.229)	Western Cape	-0.313 (-0.360)
Guesthouse, B&B	-0.360 (-0.265)	Gauteng	0.079 (-0.307)
Hotel	-0.424 (-0.260)	Eastern Cape	0.171 (-0.418)
Camping	-0.560 (-0.667)	Free State	0.042 (-0.450)
Rent house	-0.439 (-0.375)	KwaZulu-Natal	-0.184 (-0.366)
Other	0.162 (-0.446)	Mpumalanga	-0.111 (-0.505)
		Northern Cape	1.017 (-0.696)
Age	0.027 (0.008)**	North West	1.516 (0.588)**
Total spending	-0.006 (0.000)	Limpopo	-0.742 (-0.515)

SE = Standard Error ** 5% level of significance

Table 7 shows the results for the rest of the independent variables, including age, province, total spending and attitudes. The results showed negative (but insignificant) relationships between willingness to pay and respondents from the Western Cape, KwaZulu-Natal, Mpumalanga and Limpopo. Those from the North-West Province were willing to pay and the coefficient was significant at the 5% level.

The measure of the type of accommodation did not yield any significant coefficients. Age was positively and significantly associated with willingness to pay. Total spending was positive, but not significant and the coefficient was very small. Finally, there were clear

positive relationships between the main reasons people indicated they were willing to pay or not willing to pay and their WTP choices.

As an alternative to the ordered probit model, a multinomial logistic regression was also estimated. These results are not reported in detail since not all the payment groups contain observations for each of the predictor variables and when there are few observations, the standard errors of the estimated coefficients become extremely large. The method does, however, allow one to say slightly more about the predictors of willingness to pay R10, R30 and R50 compared to the base category of those who were not willing to pay to mitigate their footprint. Among those who were willing to pay R10, there were a number of significant predictors. Being married, from the Eastern Cape Province and feeling responsible for climate change were positively and significantly associated with willingness to pay. Compared to those with no schooling, all the other categories showed a negative relationship with willingness to pay and significantly so. In the case of the runners who were willing to pay R30, very few of the determinants were found to be significant. Here, all the education coefficients were positive, but insignificant.

The results for the runners who were willing to pay R50 showed that gender, marital status, home language and education coefficients were all insignificant. Compared to the professionals, the self-employed, administrative staff and civil servants were willing to pay more and the effect was significant. Age was also found to be a significant determinant of

willingness to pay for climate change mitigation.

CONCLUSIONS AND RECOMMENDATIONS

This paper made a number of important findings within the South African context.

- Firstly, there were some people who were willing to pay for a "greener" marathon. Seen within the context of the growing number of sport events in South Africa, this is a positive result. This may also have implications for other more environmentally sustainable events and tourism experiences.
- Secondly, the analysis did not find that income was an important correlate of willingness to pay, but discretionary income may be the willingness to pay of non-married people and self-employed people were significant.
- Thirdly, different sectors of the tourism and leisure industry may behave differently concerning "green issues". The international literature emphasises demographic variables, like age and education, as predictors of willingness to pay, but this was not borne out by this research amongst athletes. In related work at the Spier Wine Estate, Fourie (2011) also shows that simple socio-demographic variables do not explain willingness to pay for green initiatives.

The conclusion is that this research presents an opportunity. If people are willing to pay for "greener" and more environmentally sustainable events, the organisers of major sport events should provide it. It may make a substantial contribution to meeting corporate social responsibilities. This also presents a challenge regarding further research on segmenting the market and profiling "green" participants or attendees.

Two recommendations for future research are proposed. Surveys need to go beyond simple demographics and ask questions about people"s knowledge of and concern about the environment, climate change and mitigation. People may be "green", independent of their age, education or income. Beliefs and attitudes as predictors of willingness to pay should be explored further in greater detail. Surveys may also combine methods to shed light on willingness to pay. At tourist destinations where specific elements of the environment need protection, the contingent valuation question can be combined with travel cost analysis. There is an interesting research agenda opening in this field.

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Prof. Waldo KRUGELL: School of Economics, P.0. Box 593, North-West University, Potchefstroom Campus, Private Bag X6001, Potchefstroom 2520, Republic of South Africa. Tel.: +27 (0)18 299 1438. Fax.: +27 (0)18 299 1398, E-mail: waldo.krugell@nwu.ac.za

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WHO ARE THE COMRADES OF THE COMRADES MARATHON?

Martinette KRUGER & Melville SAAYMAN
Tourism Research in Economics, Environs and Society, North-West University, Potchefstroom Campus, Potchefstroom, Republic of South Africa.

ABSTRACT

Marathon runners' motives vary, and differ from marathon to marathon depending on the type of race. This study determined the motives of Comrades Marathon runners in order to identify and profile the market segments competing in this ultra- marathon. Intrinsic achievement, exploration and competitiveness, family togetherness and escape, socialisation and commitment were identified as the five main motives, and from these two distinct segments were classified: recreational runners and serious runners. The research showed that the typical (real) comrade of the Comrades Marathon is a person who combines the attributes of the two clusters, serious and recreational athletes, where intrinsic achievement and commitment are key motives. The study, the first of its kind at an ultra-marathon in South Africa, fills a gap in the existing literature and contributes to the literature not only on sport events but also on marathons and ultra-marathon participants in particular. It corroborates the finding that motives for participating differ

according to the sporting event, and supports the view that marketers and sports event organisers must understand that participants have different motives and so should not be regarded as a homogeneous group. This type of research is valuable to organisers, as it assists in making informed and cost-effective marketing and product development decisions.

Key words: Ultra-marathon; Comrades Marathon; Typology of motives; Marathon runner; Market segmentation; South Africa.

INTRODUCTION

Since the first „urban tour" marathon, the 1976 New York City Marathon, marathon sport has exploded globally (Burfoot, 2007). Originally referring to a race of 42 kilometres (26 miles), the word „marathon" has come to be used more broadly for a variety of long-distance races for runners. Once limited largely to the Olympics and primarily reserved for the elite athlete who trained for serious competition, these races are now held worldwide. Dozens of major cities organise marathons and despite significant personal and financial costs, many people take part each year, with some events attracting over 15 000 participants (Ogles & Masters, 2003). The Comrades Marathon is a world-renowned ultra-marathon of 89 kilometres (56 miles) that takes place between the cities of Pietermaritzburg and Durban in South Africa. The first Comrades took place on 24 May 1921, Empire Day, starting outside the City Hall in Pietermaritzburg with 34 runners. It has continued since then every year with the exception of the war years 1941–1945, with the direction alternating each year between the two cities, the so-called up- and down-runs. The Comrades Marathon is a cherished national treasure and attracts thousands of runners, spectators and television viewers every year. The 86th race took

place on Sunday 29 May 2011 and was an up-run starting in Durban and finishing in Pietermaritzburg, with over 14 000 runners participating.

Kurtzman (2005) points out that a wide variety of participants from different demographic, socio-economic and psychological groups are attracted to marathons such as the Comrades. This is because marathons can be seen as either a recreational or competitive environment, thus attracting young, old, male, female, competitive and non-competitive participants and their families as supporters, as well as businesses who wish to promote themselves and make money (Ogles & Masters, 2003). Kotze (2006) agrees that marathons can be regarded as a family affair, as often a whole family will travel to the city for the duration of the event and even extend their stay. However, Ogles and Masters (2003) point out that training for a marathon is a huge commitment, consisting of months of fitness training and long and frequent practice runs. This is a level of exercise well beyond what is required for basic health benefits. Participants can therefore have different motives for competing, which can be influenced by many factors (Shipway & Jones, 2008). The Comrades Marathon owes its beginnings to World War 1 veteran Vic Clapham. After being a soldier in the Great War, Clapham felt that all those who had fallen should be remembered and honoured in a unique way, where an individual"s physical frailties could be put to the test and overcome. This history may inspire participants in the Comrades Marathon with their own personal reasons for competing in the race. These special motives may differ significantly from those of participants in less strenuous races. Participants of the Comrades can therefore not be

regarded as homogeneous in terms of their motives for participating.

It is not only participants‟ motives that differ. Differences can also be identified between groups of participants in terms of demographic, training, performance and travel behaviour variables. Hudson (2003) explains that the more people that participate at a recreational level, the more sport equipment they tend to purchase; the more likely they are to continue to participate at a competitive level, and their propensity to watch sport may also increase. Ultimately, all of these increases related to participating, competing, and watching sport, affect the tourism industry in one way or another. It is thus important to identify the types of participants attracted to marathon races and their reasons for participating, since knowing their motives will give marketers a better understanding of participants‟ expectations, sport consumption behaviour and impact on the industry (LaChausse, 2006). Zhang *et al.* (2008) note that knowing these motives makes it possible to adapt the services provided, number of participants and length of the race (e.g. half marathon, standard marathon or ultra-marathon) so as to market the event cost effectively on the basis of participants‟ specific needs and desires. They also mention additional benefits, such as revenue for host communities, life- style upliftment for host residents and promotion of the area. The purpose of this study was to determine the motives of the Comrades Marathon runners, and on the basis of these motives, to identify and profile different market segments at the race.

LITERATURE REVIEW

Motives for participating in sport events

Brotherton and Himmetoglu (1997) and Cook *et al.* (2010) classify sport participants as a special interest group of travellers since they travel for a distinct and specific reason and

having interest-based motives for their travel to a sport event. Iso-Ahola (1982:230) defines motivation as “an internal factor that arouses, directs, and integrates a person‟s behaviour”. According to Mannell and Kleiber (1997), motivation is an activation, drive and/or reason to engage in certain behaviours and to maintain those behaviours. As indicated by Cassidy and Pegg (2008:2), as well as Parrinello (1993), “motivation therefore determines the direction and strength or intensity of behaviour”. Central to most content theories of motivation is the concept of needs (Hudson, 1999). Cassidy and Pegg (2008) state that needs are the driving force that arouses motivated behaviour and it can thus be assumed that, to understand human motivation, it is necessary to discover what needs people have and how they can be fulfilled. Sport participation also “entails primarily a set of motivational factors that are established in anticipation of the fulfilment of the desired needs” (Cassidy & Pegg, 2008:2).

Green and Chalip (1998) suggest that event planners should pay more attention to the expectations and experiences of the participants. If sport participation is a positive experience, individuals will continue to participate and become more committed to maintaining their level of involvement (Casper & Stellino, 2008). Other studies in the area of motivation for the sport participant show that motivators can be intrinsic in nature (to experience, to know, to accomplish and to be physically active) along with those based on self-determination (Gill *et al*., 1983; Ritchie & Adair, 2000; Shipway & Jones, 2008).

Motivators may also be extrinsic, such as winning trophies and gaining social prestige (Hritz & Ramos, 2008).

Research into competitive versus non-competitive sport participation found a greater emphasis on the extrinsic motives of reinforcement and competing against others for competitive athletes (Ogles & Masters, 2003; Weed & Bull, 2004), while non-competitive athletes endorsed life‟s meaning, social and participation motives (LaChausse, 2006). McDonald *et al.* (2002) identify 13 motives for participating in a sports event: physical fitness, risk-taking, stress reduction, aggression, affiliation, social facilitation, self-esteem, competition, achievement, skill mastery, aesthetics, value development and self-actualisation. Gillett and Kelly (2006) identify similar motives: competition, extrinsic achievement, socialising, camaraderie and athletic identity.

Some may of course also participate in sport for the „love of the game‟ and want their chosen sport to be fun and entertaining (Dann & Buchanan, 2006; Ko *et al*., 2008). LaChausse (2006) found that a combination of motives can lead to participation in a sport event, including health orientation, weight concern, goal achievement, competition, recognition, affiliation, coping, life-meaning and self-esteem. Participants can furthermore be motivated by the chance to spend more time with family members, friends and business associates, and in the sport setting their performance may be motivated by friendship, peer acceptance, family presence and social interaction (Weiss & Duncan, 1992; Jamber, 1999; McDonald *et al*., 2002).

Motives specific to marathons

The special nature of marathons (especially in terms of distance) means that these participants will have distinct types of motives. Among the possible motives are intrinsic rewards or goal achievement, self-esteem, competition, affiliation, socialisation and camaraderie. Marathons

can be classified into four types: shorter distance marathons; half marathons; full marathons; and ultra-marathons and the motives will be distributed differently among these types (Figure 1).

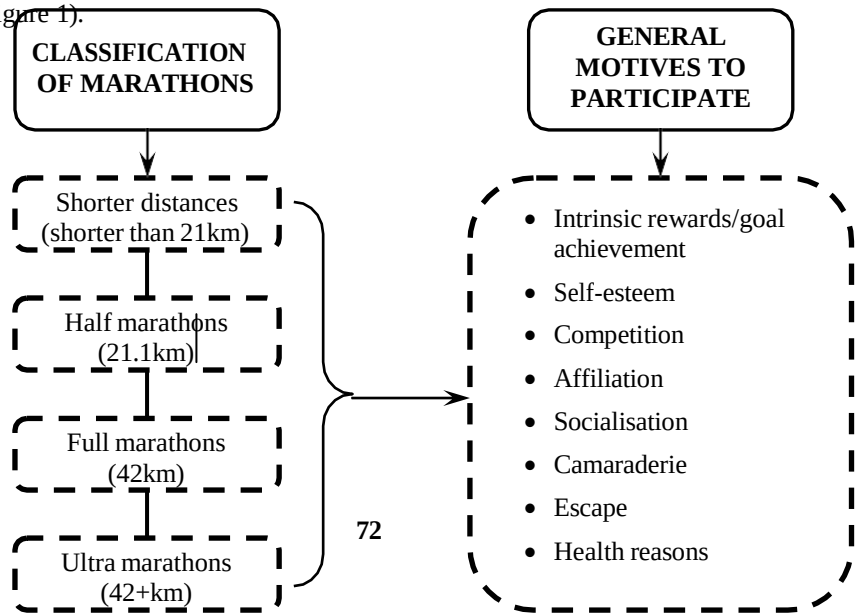

FIGURE 1: CLASSIFICATION OF MARATHONS

Ultra marathons such as the Comrades are classified as „endurance or ultra-races" (Jeffrey, 2010), that require perseverance, dedication and strenuous training programmes (Buman *et al*., 2008). Masters and Ogles (1995) and Stoll *et al.* (2000) found that the distance of the event trained for and participated in has a significant effect on athletes" reasons for running and McGehee *et al*. (2003) showed that individuals with high levels of enduring involvement in endurance running have an increase in the frequency of participation in running events, overnight travel to running events and spending on running related goods and services.

Funk *et al*. (2007) note that travelling to foreign countries and participating in endurance distance events, such as marathons, require considerable dedication and reflect long-lasting involvement with the sport. Marathon runners are thus, as Shipway and Jones (2008) call them, „serious" participants. For a marathon event such as the Comrades, distance and endurance will therefore play a significant role in participants" motives for competing. Table 1 presents a summary of the various motives for participating in marathons, as identified by a variety of studies.

TABLE 1: MOTIVES FOR PARTICIPATING IN MARATHONS

Author(s)	Study	Motives identified
Carmack & Martens (1979) Curtis & McTeer (1981) Summers *et al*. (1983)	Motives of long-distance runners	• psychological (providing a sense of life meaning or aesthetics, maintaining or enhancing self-esteem and problem solving or psychological coping) • physical (general health benefits and weight concern) • social (the desire to affiliate with other runners and to receive recognition or approval from others) • achievement (personal goal achievement and competition with other runners)
Slabbert (1981)	An exploratory study of the correlation between sport participation, personality attributes and the performance of athletes	• pleasure • achievement • competition • aggression
Ogles & Masters (2000)	Motives of older and younger male marathon runners	• life meaning • self-esteem • psychological coping • weight concern • health orientation • recognition • affiliation • competition • personal goal achievement

Ogles & Masters (2003)	Typology of marathon runners based on cluster analysis of motivations	• passion • lifestyle • personal goal achievers • personal accomplishments • competitive ambition.
Kotze (2006)	Cape Town and the Two Oceans Marathon: The impact of sport tourism	• physical, • cultural • interpersonal • status and prestige • external forces such as family, friends, social peer groups • entrepreneurial media advertising.
Funk *et al.* (2007)	Motives of international sport participation	• social interaction • escape • prestige • relaxation • cultural experience • knowledge exploration • cultural learning inventory

***TABLE 1*: MOTIVES FOR PARTICIPATING IN MARATHONS (cont.)**

Author(s)	**Study**	**Motives identified**
Gillet & Kelly (2006); Liedl (2009)	Motives of active sport participants	• health orientation • personal goal achievement • psychological well-being • self-esteem • life-meaning • social • camaraderie
Kruger & Saayman (2011)	An analysis of first-time and repeat participants at the Two Oceans Marathon	• intrinsic achievement • family togetherness • escape and relaxation • socialisation and affiliation • event novelty • competitiveness

It is clear from the table that marathon runners‟ motives are heterogeneous. Since individual runners will have different motives for running and perhaps even multiple motives (Ogles & Masters, 2003; Shipway & Jones, 2008), profiles of their motives, in the form of motivational variables, can be used to examine and identify the different kinds of participant. However, regardless of the value of motives, few researchers have clustered marathon runners on the basis of their motives for participating. Masters and Ogles (1995), finding that these motives differ as a function of experience, distinguish three types of marathon runners: veteran; mid- level; and rookie. The most experienced group, the veterans, adopted a social identity as a marathon runner that included both competitive and

health aspects. As expected, the mid- level runners were motivated primarily by personal performance enhancement and psychological rewards, whereas marathon identity played a secondary role. The rookies appeared less motivated by a marathon identity and since they had not yet completed a full marathon, they were less concerned with personal improvement.

In a later study, Ogles and Masters (2003), further categorise marathon runners into five types: running enthusiast (older participants, 50 years and older, attending many marathon events, more likely to run with other runners and disproportionately female), lifestyle manager (participants more likely to run alone, tending to run more slowly, training fewer kilometres and days, less likely to train twice in one day, and also disproportionately female), personal goal achievers (somewhat younger participants, with faster running times, training more kilometres, and disproportionately male), personal accomplishers (participants rated as average on training, running speed and attendance at marathons, and disproportionately male) and competitive achievers (predominantly younger, 20 to 28 years, faster runners, training more days, likely to also train twice a day, and disproportionately male).

To date only three other studies have been done to determine people‟s motives for participating in sporting events in South Africa. A study of cyclists in the Cape Argus Pick n

Pay Cycle Tour in Cape Town (Streicher & Saayman, 2010) revealed five motives: socialisation, event attractiveness, personal motivation, escape and relaxation and event attributes. The results showed that participants‟ motives were mainly intrinsic, such as personal motivation and escape and relaxation, while the event itself was also regarded as a major reason for participating. Kruger *et al*. (2011) identified three motives for swimmers at the Midmar Mile, near Pietermaritzburg: socialisation and escape; fun and entertainment; and intrinsic achievement, where the third was considered the most important. However, in addition to being goal-orientated, participants in the Midmar Mile are also driven by the need for social interaction and escape. These motives were used to categorise Midmar Mile participants into three distinct segments: devotees; aficionados; and recreationalists. In their study of participants at the Old Mutual Two Oceans Marathon, Cape Town, Kruger and Saayman (2011) identified six motives: intrinsic achievement; family togetherness; escape; and relaxation; socialisation and affiliation; event novelty; and competitiveness. On the basis of the results, it was suggested that all three events should combine the event attractiveness with achievement of personal (intrinsic) goals in their marketing campaigns. This supports the argument by Gill and Williams (2008) that understanding the motives of participants is critical, since it has implications for the development of marketing strategies, particularly when attempting to match the sports event offering with the motivational bundle being sought by the sport participants.

The present study attempts ultimately to identify the real „comrades‟ of the Comrades Marathon, in other words the market(s) that marketers should target. As this approach has never been applied to endurance runners in South Africa, the research will also expand the limited knowledge and literature, an aim identified as important by Weed (2006).

METHODOLOGY

The questionnaire

A 3-section structured questionnaire, based on the work of McDonald *et al.* (2002), Ogles and Masters (2003) and LaChausse (2006), was used to collect the data. Section A captured demographic details (gender, home language, age, occupation, home province, marital status and preferred accommodation), and spending behaviour (number of persons paid for, length of stay and expenditure). Section B captured specific information about the race (initiator of participation, frequency of participation, repeat participation, other tourist attractions visited and information sources regarding the event), while Section C captured the motivational factors for competing in the race. In the motivation section, 24 items were measured on a 5- point Likert scale where respondents indicated how important they considered each item to be on a scale where 1=not at all important to 5=extremely important. This section also captured participants‟ marathon running history and how their participation in sport events influenced their holiday choice and travel behaviour. Eleven statements pertaining to the latter were measured on a 5-point Likert scale with 1=never, 2=almost never, 3=sometimes, 4=regularly and 5=always. For the purposes of this research, the information obtained from sections A, B and C was used predominantly.

Survey and sampling method

A destination-based survey was undertaken and questionnaires were handed out on-site at the Bonitas Comrades Expo in Durban during the registration period (27-29 May 2011).

Participants were selected after they had completed their registration. The field workers were trained to ensure that they understood the aim of the study as well as the questionnaire. Fieldworkers were also trained to assist respondents (especially foreign language participants) with the interpretation of the questionnaires. Respondents were briefed about the purpose of the research beforehand to ensure that they participated willingly and responded openly and honestly. A total of 450 questionnaires were distributed over a period of 3 days and 437 completed questionnaires were included in the analysis. According to Israel (2009:6), from a population of 100 000 (N), 398 respondents (n) are seen as representative and result in a 95% level of confidence. Since approximately 14 900 athletes participated in the race, the number of completed questionnaires is greater than the number required.

Statistical analysis

Microsoft© Excel© was used to capture the data and SPSS (2011) to analyse it. The analysis was done in 3 stages: 2 factor analyses; a cluster analysis; and an analysis of significant differences between the motivational clusters.

Firstly, two principal axis factor analyses, using an Oblimin rotation with Kaiser Normalisation, were performed on the 24 motivation items and the 11 holiday choice items, to explain the variance-covariance structure of a set of variables through a few linear combinations of these variables. The Kaiser-Meyer-Olkin measure of sampling adequacy was used to determine whether the covariance matrix was suitable for factor analysis. Kaiser‟s criteria, for the extraction of all factors with eigenvalues larger than one, were used because they were considered to explain a significant amount of variation in the data. All items with a factor loading greater than 0.3 were considered as contributing to a factor,

and all items with loadings less than 0.3 as not correlating significantly with this factor (Steyn, 2000). Any item that cross-loaded on two factors with factor loadings both greater than 0.3, was categorised in the factor where interpretability was best. A reliability coefficient (Cronbach‟s alpha) was computed for each factor to estimate its internal consistency. All factors with a reliability coefficient above 0.6 were considered as acceptable in this study. The average inter-item correlations were also computed as another measure of reliability. These, according to Clark and Watson (1995), should lie between 0.15 and 0.55.

Secondly, a cluster analysis, using Ward‟s method with Euclidean distances, was performed on the scores of the motives for participating. A cluster analysis is a multivariate interdependence technique, of which the primary objective is to classify objects into relatively homogeneous groups on the basis of the set of variables considered and is mostly an exploratory technique (Hair *et al*., 2000). Hierarchical clustering makes no assumptions about the number of groups or group structure. Instead, the members are grouped together on the basis of their natural similarity (Johnson & Wichern, 2007). This research did not take a priori view of which data points should fall into which segment. Rather, a hierarchical cluster analysis was used to explore the natural structure of the data, by means of Ward‟s method with Euclidean distances.

Lastly, once the clusters were identified, multivariate statistics were used to examine any statistically significant differences between the motivational clusters. Two-way frequency tables and Chi-square tests were used to profile the clusters demographically, and t-tests to investigate any significant differences between clusters concerning socio-demographic and

behavioural variables. The study used demographic variables (age, gender, home language, province of origin, marital status, level of education) and behavioural variables (average spending per person, length of stay, repeat visit, category participated in, initiator of participation, other tourist attractions visited, type of accommodation) to examine whether statistically significant differences existed between different groups.

RESULTS

Factor analyses

The pattern matrix of the principal axis factor analyses using an Oblimin rotation with Kaiser normalisation identified 5 participant motivational factors and 2 holiday choice factors that were labelled according to similar characteristics (Tables 2 and Table 3).

***TABLE 2*: RESULTS OF FACTOR ANALYSIS OF COMRADES PARTICIPANTS**

Motivation factors and items	Factor loading	Mean value	Reliability coefficient	Average inter-item correlation
Factor 1: Intrinsic achievement		**3.94**	**0.90**	**0.46**
To feel proud of myself and to feel a sense of achievement	0.86			
The atmosphere of the Comrades	0.75			

Comrades is a major challenge	0.74			
It is a "must do" event	0.62			
Because I enjoy running	0.58			
It is an international event	0.56			
Because the event is well-organised	0.42			
To make my friends and family proud of me	0.41			
To compete against myself, to improve my running speed and/or to beat a certain time	0.40			
To improve my health	0.35			
To share group identity with other runners	0.28			
Factor 2: Exploration & competitiveness		**2.77**	**0.81**	**0.51**
To explore the area	0.69			
Reason to visit Pietermaritzburg/ Durban	0.67			
It is an international event	0.56			
To compete against some of the best runners in the country	0.53			
Factor 3: Family togetherness and escape		**3.10**	**0.71**	**0.38**
To spend time with family	0.64			
To relax	0.60			
Because the whole family can participate	0.59			
To get away from normal routine & stress	0.43			

***TABLE 2*: RESULTS OF FACTOR ANALYSIS OF COMRADES PARTICIPANTS (cont.)**

Motivation factors and items	**Factor loading**	**Mean value**	**Reliability coefficient**	**Average inter-item correlation**
Factor 4: Socialisation		**3.20**	**0.82**	**0.61**
To meet new people	0.80			
To socialise with other runners	0.79			
To spend time with friends	0.63			
Factor 5: Commitment		**3.44**	**0.66**	**0.50**
I do it annually	0.80			
I am pursuing a personal goal of participating in a certain number of marathons	0.44			
TOTAL VARIANCE EXPLAINED	**56%**			

These factors accounted for respectively 56 and 53% of the total variance. All had relatively high reliability coefficients, ranging from 0.66 (the lowest) to 0.90 (the highest) for the motivational factors and 0.45 (the lowest) to 0.86 (the highest) for the holiday choice factors. The average inter-item correlation coefficients with values between 0.38 and 0.51 for the motivational factors and 0.32 and 0.48 for the holiday choice factors, also implied internal consistency for all factors.

Moreover, all items loaded on a factor with a loading greater than 0.3 and the relatively high factor loadings indicated a reasonably high correlation between the factors and their component items. The Kaiser-Meyer-Olkin measures of sampling adequacy of 0.89 for the motivational factors and 0.91 for the holiday choice factors also indicated that patterns of correlation were relatively compact and yield distinct and reliable factors (Field, 2005). Barlett‟s test of sphericity also reached statistical significance ($p<0.001$) in both cases,

supporting the factorability of the correlation matrix (Pallant, 2007).

Factor scores were calculated as the average of all items contributing to a specific factor in order to interpret them on the original 5-point Likert scale of measurement. As Table 2 shows, the following motives for the Comrades participants were identified: intrinsic achievement (Factor 1); exploration and competitiveness (Factor 2); family togetherness and escape (Factor 3); socialisation (Factor 4); and commitment (Factor 5). Intrinsic achievement obtained the highest mean value (3.94), was considered the most important motive for participating in the race, and had a reliability coefficient of 0.90 and an average inter-item correlation of 0.46. Commitment had the second highest mean value (3.44), followed by socialisation (3.20) and family togetherness and escape (3.10). Exploration and competitiveness had the lowest mean value (2.77) and was rated as the least important motive for participating in the race.

***TABLE 3*: RESULTS OF FACTOR ANALYSIS OF THE INFLUENCE OF SPORT PARTICIPATION ON HOLIDAY CHOICE AND TRAVEL BEHAVIOUR**

Holiday choice and travel behaviour items	**Factor loading**	**Mean value**	**Reliability coefficient**	**Average inter-item correlation**
Factor 1: Primary influences		**3.22**	**0.86**	**0.48**
My sport participation gives me the opportunity to explore the country	0.91			
I plan my sport participation in order to see different places and destinations	0.82			
Participation in sport gives me the opportunity to travel	0.73			
I also take a holiday during my participation in marathons	0.71			
Participation in sport allows me to take my family and friends along on the trip	0.57			
I take a holiday in the town or area where I have participated	0.50			
My sport participation gives me the opportunity to travel overseas	0.44			
Factor 2: Secondary influences		**3.14**	**0.45**	**0.32**
I prefer to go on holiday at a different destination than where I have participated – at least once a year	0.68			
My sport participation and holiday destination differ	0.58			
I prefer not to spend a lot of time at the destination where I participate in a	0.40			

particular sport My holiday destination needs to give me the opportunity to train	0.22	
TOTAL VARIANCE EXPLAINED	**53%**	

When comparing the results with previous research on sport events motives in general, as well as marathon motives, „intrinsic achievement" as a motive is supported by Ogles and Masters (2000; 2003), Kruger *et al*. (2011) and Saayman and Kruger (2011), while Ogles and Masters (2000), Gillet and Kelly (2006), Dann and Buchanan (2006), Ko *et al*. (2008), and Saayman and Kruger (2011) identified „competitiveness". However, „exploration" has not yet been identified as a motive. The motives „family togetherness" and „escape" have also been identified by Weiss and Duncan (1992), Jamber (1999), McDonald *et al*. (2002), Kruger *et al.*

(2011) and Saayman and Kruger (2011), and „socialisation" by Funk *et al*. (2007), Streicher and Saayman (2010), Kruger *et al.* (2011) and Saayman and Kruger (2011). „Commitment" has also not been identified in previous research as a motive for competing in marathon races. Furthermore, a comparison of the South African studies shows that swimmers, cyclists and runners have significantly different motives for participating in their respective sports.

With regard to the influence of participation in sport on participants" holiday choice and travel behaviour (Table 3), 2 factors were identified: „primary influences" (Factor 1) and

„secondary influences" (Factor 2). „Primary influences" obtained the higher mean value (3.22) of the 2 factors, indicating that participants felt that their participation in sport *sometimes* influenced their holiday choice and travel behaviour. However, the mean value of „secondary influences" (3.14) indicated that participants also felt that they prefered to take a holiday at a destination other than where they had to participate.

Results of the cluster analysis

An exploratory cluster analysis based on all cases in the data was performed on the motivational factors. A hierarchical cluster analysis, using Ward"s method of Euclidean distances, was used to determine the clusters" structures on the basis of the motivation factors. A 2-cluster solution was selected as the most discriminatory (Figure 2). The results of the multivariate analyses were used to identify the 2 clusters and to discover whether significant differences existed between them ($p<0.05$).

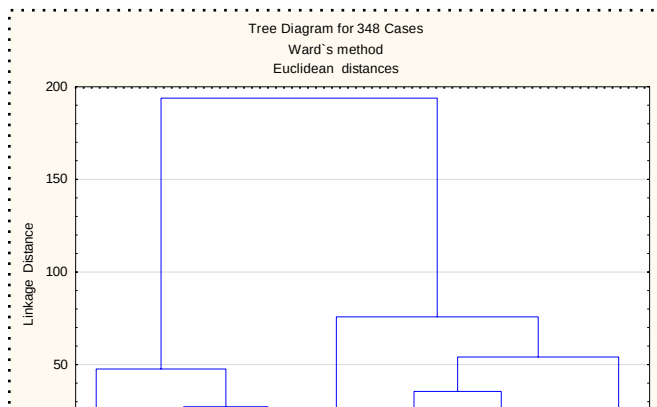

FIGURE 2: **TWO CLUSTER SOLUTION: WARD'S METHOD WITH SQUARED EUCLIDEAN DISTANCE MEASURES**

Identification of segmented clusters

As Table 4 shows, t-tests indicated that all 5 motivational factors contributed to differentiating between the 2 motivational clusters ($p<0.05$).

TABLE 4: **T-TEST RESULTS FOR MOTIVATIONAL FACTORS IN TWO CLUSTERS OF COMRADES PARTICIPANTS**

	Cluster 1 Recreational runners			Cluster 2 Serious runners			t-	
Travel motives	**Mean**	**SD**	***N***	**Mean**	**SD.**	***N***	**value**	**p**
Intrinsic achievement	3.60	0.86	205	4.46	0.45	142	10.84	< 0.05
Exploration and competitiveness	2.22	0.88	205	3.55	0.97	142	13.28	< 0.05
Family together-ness and escape	2.63	0.90	205	3.68	0.91	142	10.64	< 0.05
Socialisation	2.58	0.94	205	4.07	0.69	142	16.16	< 0.05
Commitment	2.84	1.26	205	4.29	0.83	142	11.94	< 0.05

Cluster 1 contained the largest sample of respondents (205) and had the lowest mean values for all 5 of the motives. This cluster was thus labelled „recreational runners". Cluster 2 was labelled „serious runners" and contained 142 respondents. This second cluster had the highest mean scores across the 5 motivation factors especially for „intrinsic achievement",
„commitment" and „socialisation".

Results from the independent t-test

Independent t-tests were conducted to determine whether there were significant differences between the 2 clusters of participants at the Comrades Marathon. The significant results are discussed in this section.

TABLE 5: **DIFFERENCES BETWEEN MOTIVATIONAL CLUSTERS (t-Test)**

Variables	Cluster 1 Recreational runners Mean	SD	N	Cluster 2 Serious runners Mean	SD	N	t-value	p
Age	42.04	9.32	199	43.22	9.19	140	-1.155	0.249
Group size	5.96	10.28	204	12.77	27.12	139	-3.236	0.001**
No. people paid for	2.34	3.63	198	2.40	4.66	135	-0.135	0.892
nights in Durban/ Pietermaritzburg	4.30	2.43	179	4.12	2.55	122	0.594	0.553
Times participated in Comrades	4.87	5.07	204	6.15	5.17	137	-2.172	0.031**
Average marathons in lifetime	28.19	60.17	187	32.18	52.54	131	-0.614	0.540
Average marathons per year	3.43	2.49	197	4.54	4.04	131	-3.079	0.002**

***TABLE 5*: DIFFERENCES BETWEEN MOTIVATIONAL CLUSTERS (t-Test) (*cont.*)**

Variables	Cluster 1 Recreational runners Mean	SD	N	Cluster 2 Serious runners Mean	SD	N	t-value	p
Spending categories	Rand			Rand				
Entry fees	528.91	375.38	205	794.59	417.51	142	-0.593	0.554
Accommodation	8004.70	2504.73	205	3755.10	2139.10	142	0.507	0.613
Transport	5686.16	2080.12	205	1978.79	1373.00	142	1.423	0.156
Running gear	1508.08	1168.39	205	2703.50	1519.75	142	-1.546	0.123
Food & restaurants	1735.42	1028.20	205	1753.12	1086.90	142	-0.309	0.758
Beverages	552.65	276.07	205	572.36	285.70	142	-0.159	0.874
Medicines	298.81	159.24	205	381.88	203.45	142	-1.208	0.228
Souvenirs	565.60	287.41	205	467.19	269.61	142	0.309	0.757
Spending per person	10330.37	5695.91	186	4710.23	4417.19	129	1.314	0.190
Holiday choice behaviour								
Primary influences	2.92	0.89	194	3.66	0.87	134	-7.361	0.001**
Secondary influences	2.91	0.74	194	3.47	0.92	134	-6.041	0.001**
Days spent in area where marathon is held	2.49	1.76	182	2.70	1.93	122	-0.943	0.346

** Significance at the 5% level

As Table 5 shows, there were significant differences between the 2 clusters of runners based on group size (p=0.001), times participated in the Comrades (p=0.031), average marathons per year (p=0.002) and the holiday choice behaviour factors, primary influences (p=0.001) and secondary influences (p=0.001). Serious runners travelled in larger groups (an average of 13 persons), had participated in the race more times (an average of 6 times)

and competed in more marathons per year (an average of 5 marathons) than recreational runners, who travelled in smaller groups (an average of 6 persons), had participated in the Comrades fewer times (an average of 5 times) and competed in fewer races per year (an average of 3 races). With regard to holiday choice behaviour, serious runners‟ participation *regularly* influenced their travel behaviour, while this was only *sometimes* the case for recreational runners. Sport participation, however, also *sometimes* had a lesser influence on serious runners‟ travel behaviour, indicating that these participants were inclined to travel irrespective of their sport participation to destinations other than those where they compete.

No significant differences were found between the 2 clusters as regards to other socio-demographic and behavioural determinants. Both groups of runners were in their early forties, were financially responsible for 2 persons during the event, stayed an average of 4 nights in Durban or Pietermaritzburg, had completed between 28 and 32 marathons in their lifetime and spent from 2 to 3 days in the area where the marathons they competed in were held.

Recreational runners spent more during the race (an average of R5696) than serious runners (an average of R4417), especially on accommodation and transport.

Cross-tabulations and chi-square test results

Table 6 shows that there were statistical significant differences between recreational and serious runners with regard to high-income occupation (p=0.026), level of education (p=0.023), repeat participation (p=0.005), television (p=0.036) and magazines (p=0.047) as sources of information, decisions made to attend (p=0.001), other tourist attractions visited (p=0.050) and participation in other sport activities (p=0.014). At the 10% level of significance, foreign and African languages (p=0.087), clubs (p=0.066) as an initiator of participation and word of mouth (p=0.077), as a source of information also indicated significant differences.

***TABLE 6*: CHI-SQUARE TEST RESULTS OF PARTICIPANT CHARACTERISTICS**

Characteristics (n=437)	**MOTIVATIONAL CLUSTERS** Cluster 1 Recreation runners	Cluster 2 Serious runners	**Chi Square Value**	**df**	**p**	**Phi-Value**
Gender			1.539	1	0.215	-0.068
Male	73%	79%				
Female	27%	21%				
Home language						
English	Yes=37%	Yes=32%	0.607	1	0.436	-0.042
Afrikaans	Yes=46%	Yes=42%	0.429	1	0.513	-0.035
Foreign & African	Yes=18%;	Yes=25%	2.936	1	0.087*	0.092
Occupation						
High income	Yes=48%	Yes=36%	4.966	1	0.026**	-0.120
Medium income	Yes=40%	Yes=45%	0.850	1	0.357	0.050
Low income	Yes= 7%	Yes= 6%	0.392	1	0.531	-0.034
Province						
KwaZulu-Natal	Yes=16%	Yes=21%	1.471	1	0.225	0.066

Gauteng	Yes=40%	Yes=40%	0.001	1	0.979	0.001
Level of education			13.034	5	0.023**	0.195
No school	1%	5%				
Matric	28%	32%				
Diploma, degree	34%	35%				
Postgraduate	27%	16%				
Professional	9%	9%				
Other	2%	4%				
Marital status			7.538	4	0.110	0.148
Married	64%	67%				
Not married	19%	24%				
Divorced	9%	7%				
Widow/er	2%	1%				
Living together	6%	1%				

***TABLE 6*: CHI-SQUARE TEST RESULTS OF PARTICIPANT CHARACTERISTICS (n=437) (*cont.*)**

	MOTIVATIONAL CLUSTERS		**Chi**			
	Cluster 1	Cluster 2	**Square**			**Phi-**
Characteristics	Recreation runners	Serious runners	**Value**	**df**	**p**	**Value**
Initiator of attendance						
Self	Yes=62%	Yes=63%	0.131	1	0.717	0.019
Spouse	Yes= 9%	Yes=10%	0.034	1	0.854	0.010
Media	Yes= 3%	Yes= 4%	0.424	1	0.515	0.035
Friends	Yes=30%	Yes=25%	0.808	1	0.369	-0.048
Children	Yes= 4%	Yes= 3%	0.296	1	0.586	-0.029
Family	Yes=13%	Yes= 9%	1.327	1	0.249	-0.062
Club	Yes=11%	Yes=18%	3.385	1	0.066*	0.099
Organisation	Yes= 2%	Yes= 3%	0.279	1	0.597	0.028
Preferred type of accommodation			0.015	1	0.901	-0.007
Paid accom.	Yes=69%	Yes=70%				
Participate again			10.709	2	0.005**	0.177
Yes, definitely	66%	82%				
No, definitely not	7%	2%				
Perhaps	27%	16%				

Main sources of information						
Television	Yes=40%	Yes=51%	4.418	1	0.036**	0.113
Radio	Yes=18%	Yes=14%	0.960	1	0.327	-0.053
Website	Yes=10%	Yes=10%	0.001	1	0.975	0.002
Email	Yes=10%	Yes= 7%	0.376	1	0.376	-0.047
Magazines	Yes=17%	Yes= 9%	3.955	1	0.047**	-0.107
Newspapers	Yes=13%	Yes=11%	0.158	1	0.691	-0.021
Word of mouth	Yes=38%	Yes=29%	3.134	1	0.077*	-0.095
Club	Yes=31%	Yes=30%	0.107	1	0.744	-0.018
Decision made to participate			14.155	2	0.001**	0.205
Spontaneously	37%	56%				
More than a month ago	53%	41%				
Other	10%	3%				
Other tourist attractions visited	Yes=46%	Yes=57%	3.843	1	0.050**	0.105
Participate in other sport act.	Yes=54%	Yes=39%	6.032	1	0.014**	0.139

** Significance at the 5% level and * indicates significance at the 10% level

The significant differences are discussed and presented below.

- More serious runners were foreign participants or participants who speak African languages.
- More recreational runners were in high-income occupations and had a higher level of education, which could explain their higher spending at the race.
- Significantly more serious runners said they would definitely compete in the Comrades again, while more recreational runners were unsure about this.
- More serious runners had heard about the race from television, while recreational runners consulted magazines. More recreational runners had heard about the event through word-of-mouth recommendations.
- Their affiliated club had initiated more serious runners‟ participation.
- Surprisingly, more recreational runners had made their decision to participate in the race well in advance, while more serious runners had made their decision to compete
  „spontaneously‟.
- More serious runners had visited other tourist attractions in the area coincidentally with the race.
- Significantly more recreational runners participated in other sport activities, while serious runners were not likely to participate in sport activities other than marathon running.

There were no statistically significant differences between the 2 clusters as regards other variables. Both clusters were predominantly male, married, Afrikaans-speaking, from

Gauteng Province, made use of paid accommodation during the race and initiated their participation in the race themselves.

FINDINGS AND IMPLICATIONS

The results of this study show that the ultra-marathon runners surveyed were motivated by intrinsic achievement, exploration and competitiveness, family togetherness and escape, socialisation and commitment. The cluster analysis, which segmented runners according to these motives, revealed two distinct segments that were labelled recreational runners and serious runners. The study found that these ultra-marathon runners were mainly motivated by intrinsic achievement and this applied for both clusters. Commitment was also identified as a primary motive for the first time. In comparison with previous studies, it was clear that a different combination of motives was at play. An interesting finding was that in addition to being goal-orientated, participants were also driven by the need for social interaction, family togetherness and escape. By corroborating the findings by Ogles and Masters (2003) and Shipway and Jones (2008), these two clusters differed in terms of not only their motives but also their socio-demographic variables. These clusters furthermore differed significantly from the clusters of runners identified by Ogles and Masters (2003). The two clusters of Comrades runners in this study did, however, show some similarities with the veteran marathon runners and mid-level runners identified by Masters and Ogles (1995) and the clusters of swimmers (devotees, aficionados and recreationalists) identified by Kruger *et al*. (2011). The results furthermore corroborate the finding that motives, and therefore clusters of participants, differ

from one event to another, which means that what attracts participants to one event may not necessarily work for another. The results also indicated that the combination of intrinsic motives seemed to be more intense than that of other categories of marathon runners, which may perhaps be explained by the emphasis on comradeship in the history and title of the race.

The findings of this study suggest the following implications. Firstly, the typical (real) comrade of the Comrades Marathon is a person who combines the attributes of the two clusters, serious and recreational athletes, where intrinsic achievement and commitment are key motives. Recreational runners spend more per person and they are also more in numbers; hence they are a good market to attract if the event is to increase its economic contribution to the region. The finding that recreational runners spent more (an average of R5696) than serious runners (an average of R4417), is also an interesting contradiction of the findings by McGehee *et al*. (2003) and Kruger *et al*. (2011), that the more serious athletes were inclined to spend more.

However, the serious runners seem to visit more tourist attractions and therefore from a tourism point of view they are also an important market. This supports the finding by McGehee *et al.* (2003) and Funk *et al.* (2007) that participants with high levels of involvement in endurance running do more travelling to running events and destinations where events are held. Marketers of the Comrades Marathon should therefore follow a two-pronged approach, focusing on both recreational and serious runners. Recreational runners can be targeted by means of magazines and serious runners by means of clubs. In the case of the serious runners, club competitions could also lead to a greater number of participants.

The important role of clubs is also evident in the recreational runners‟ decision-making process and larger group sizes. Both marketing campaigns must combine the appeal to achievement of personal (intrinsic) goals with socialisation and escape.

Secondly, it seems that since serious runners are running more marathons than recreational runners, they take less time to decide whether to participate. One possible reason for this is that they know they will qualify since they compete in more marathons; therefore they are prepared for the race. Recreational runners plan longer in advance in order to be ready. Event organisers could use other marathon events to market or attract more serious runners.

Lastly, events such as these have a clear impact on tourism and travel behaviour. Participation in sport of this nature exposes runners to travel and this can become a habit or even a lifestyle (Shipway & Jones, 2008). This is confirmed by the fact that serious runners compete more regularly in marathons and these marathons take place all across the country, as well as in other countries. Therefore, marathons, especially the Comrades, create an „extension effect‟, which implies that in order to qualify for one event, one needs to compete in other marathons. Hence, the Comrades Marathon influences participation at other events. Seeing that these events take place on existing infrastructure, it is no wonder that cities are keen to host them.

CONCLUSION

This study determined the motives of runners for participating in the Comrades Marathon and clustered the participants according to these motives. This type of research was conducted for the first time at an ultra-marathon in South Africa and the profile and motives of these

athletes have been identified. With these results, gaps in the existing literature have been filled, since this research contributes to the literature not only of sport events but also of marathons and specifically ultra-marathon participants. The study corroborates the argument that motives for participating differ according to the sporting event, and supports the view that marketers and sport event organisers must understand that participants have different motives and so should not be regarded as a homogeneous group (Hinch & Higham, 2004; Weed & Bull, 2004; Weed, 2006). In fact, this study showed not only that motives for participating in ultra-marathons differ from those participating in other types of marathons, but also that the combination of motives differed.

The study in addition showed that participation in sport has a definite impact on a participant‟s travel behaviour and that there is a significant relationship between sport and tourism. This type of research is valuable to sport event organisers, as it assists in making informed and cost-effective marketing and product development decisions. The typical (real) comrade has the attributes as indicated in the two clusters. It is thus recommended that similar research, comparing participants‟ motives and whether they are primarily intrinsic, extrinsic or a combination, be undertaken for other marathon events, as well as other South African sporting events. Further research should also investigate whether travel motives, and especially intrinsic motives, are a driving force for travel and tourism.

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Prof. Martinette KRUGER: TREES (Tourism Research in Economics, Environs and Society), North West University, Private Bag X6001, Potchefstroom 2520, Republic of South Africa. Tel.: +27 (0)18 299 1980, E-mail: Martinette.Kruger@nwu.ac.za

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A COMPARATIVE STUDY OF KNOWLEDGE SHARING BEHAVIOUR OF PHYSICAL EDUCATION AND SPORT PROFESSIONALS

Chao-Chin LIU*, Shang-Min MA**, Chin-Liang HO*** & Yi-Hui LIU****
**Department of Recreation Sport and Health Promotion, Mei-Ho University, Pingtung, Taiwan*
***Department of Recreational Sport and Health Promotion, National Pingtung University of Science and Technology, Pingtung, Taiwan*
****Department of Sports, Taipei City Government, Taipei City, Taiwan*
*****Department of Industrial Technology Education, National Kaohsiung Normal University, Kaohsiung, Taiwan*

ABSTRACT

This study compared different theories on the knowledge sharing behaviour of sport professionals and considers the differences according to occupation. A questionnaire was distributed to professionals in physical education and sport in Taiwan. The subjects were targeted using a stratified random sampling method. Structural equation modelling was used to perform data analysis on 666 valid questionnaires. The Theory of Planned Behaviour (TPB) explained the behavioural models regarding their interpretation of knowledge sharing behaviour and intentions. The findings indicated that such behaviour indirectly, but positively, impacted by subjective norms, shared attitudes, perceived behavioural control and shared intentions. Knowledge sharing behaviour differed significantly among sport professionals employed in academia and industry, with the intention to share exerting the greatest influence. Attitude was the most influential, followed by subjective norms and perceived behavioural control. In the industrial model, perceived behavioural control was most consequential, followed by attitudes and subjective norms. The results confirm that the theory of planned behaviour not only has good explanatory power, but also effectively predicts such behaviour

among physical education and sport professionals in general.

Key words: Theory of Planned Behaviour, Professionals of Physical Education and Sport, Knowledge Sharing Behaviour, Model Comparison.

INTRODUCTION

The 21st century is the age of the knowledge economy. Its development has been driven by innovation, technology, information, globalisation and competitiveness. Knowledge is an asset that grows with use; it is also the only unlimited resource in the world (Small & Sage, 2006; Lai, 2010). Since knowledge is constantly changing, the critical part of a knowledge economy is not the knowledge itself, but rather „knowledge management" driven by the attainment, storage, dissemination and application of knowledge in innovative ways, which benefit individuals or organisations (Small & Sage, 2006). The priority for managers of a knowledge economy is sharing knowledge (Thurow, 2003; Sheikh, 2008). Only through sharing can organisations capitalise on the value of knowledge. Knowledge management has

thus become an important means of measuring organisational learning (Brauner & Becker, 2006).

Knowledge sharing is important, as knowledge differs from common tangible assets that offer diminishing returns on investment (Helms *et al*., 2010). Physical Educators and sport professionals are not only knowledge workers and managers, but also knowledge and information transformers, as well as communicators, transformers and sharers of theories, experiences and technologies (Edvinsson & Malone, 1997). Sport academics and the sport industry have recently discovered the importance of sharing knowledge. In a knowledge economy, sharing can enable the accumulation and renewal of the stocks of knowledge that broaden sport academia and the sport industry (Su, 2009; Chen, 2010; Tsai, 2010). Therefore, the implementation of knowledge sharing among sport professionals should facilitate the utilisation and transformation of individual expertise into organisational knowledge, which can in turn be used to enhance organisational performance. The study of knowledge sharing has hitherto mainly focused on corporations, rather than sport professionals, especially in systems theory-based approaches. In contrast, this study used different theoretical models to compare the knowledge sharing behaviours of sport professionals. The study's objectives were: (1) to compare the knowledge sharing behaviours of different sport professionals to models of intention; and (2) to compare the knowledge sharing behaviour models of sport professionals from different occupational fields.

In terms of behavioural theories, earlier studies have favoured the Theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TPB) and the Modified Theory of Planned Behaviour (MTPB). The TRA was introduced in 1967, with the main assumption being that humans are rational individuals. Behavioural Intentions (BI) is determined by the Attitudes Toward behaviour (AT) and Subjective Norms (SN). The AT include positive and negative evaluations. SN is influenced by society (Fishbein & Ajzen, 1975; Goldberg *et al*., 1997). Therefore, the TRA assumes that attitudes and subjective norms are independent and that behaviours (BE) may be indirectly influenced by BI (Fishbein & Ajzen, 1975; Ajzen &

Fishbein, 1980). The structure of the TRA is shown in H1, H2 and H3 in Figure 1. It includes the dependent variables of individual behaviours and behavioural intentions, as well as the independent variables of individual behaviour, namely attitudinal tendencies and subjective norms (Ajzen, 2001a; Ryu *et al*., 2003).

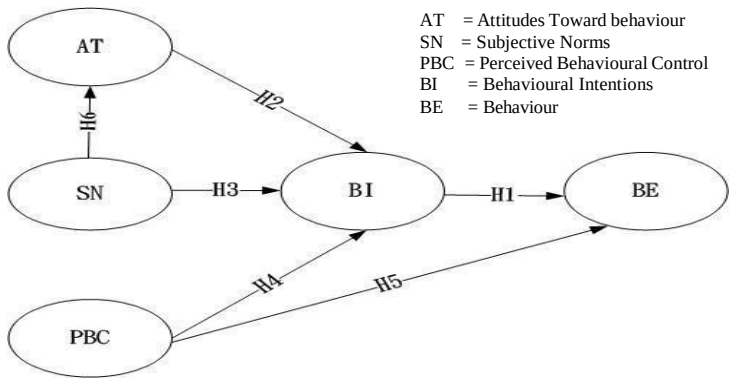


***FIGURE 1*: HYPOTHESISED STRUCTURE MODEL**

Ajzen (1991), devised the theory of planned behaviour and claimed that behavioural intentions were not only influenced by attitudes and subjective norms in the Theory of Reasoned Action model, but also by perceived behavioural control. The Theory of Planned Behaviour (TPB) stresses how behaviours are determined by „Behavioural Intentions" (BI), which are influenced by „Attitudes Toward Behaviour" (AT), „Subjective Norms" (SN) and
„Perceived Behavioural Control" (PBC). The process by which it is formed and analyses behaviour, and the structure of the TPB is shown in H1, H2, H3, H4, and H5, in Figure 1.

The results of Ajzen"s earlier research (1985), can be compared to other works (Shimp & Kavas, 1984; Vallerand *et al*., 1992), that indicate how SN of personal behaviour directly influences AT. These empirical research results modified the TBP model into the MTBP model. The structure of the MTBP is shown in H1, H2, H3, H4, H5, and H6, in Figure 1.

All three models maintain that behaviour determines personal BI, whereas the TPB and MTBP models add „Perceived Behavioural Control" (PBC) as an influence. Regarding the factors that influence BI, there are some slight differences among the three models. The Theory of Reasoned Action (TRA) stresses how ATB and SN determine BI. The Theory of Planned Behaviour (TPB) maintains that AT, SN and PBC are the most consequential variables (Chau & Hu, 2001). The MTPB model adds the subjective norm"s influence to the attitudes toward behaviour, which enhances its predictive ability in relation to individual behaviour.

The three theories applicable to this study include: the Theory of Reasoned Action (TRA) (Hypothetical model: H1, H2 and H3), the Theory of Planned Behaviour (TPB) (Hypothetical model: H1, H2, H3, H4 and H5) and the Modified Theory of Planned Behaviour (MTPB) (Hypothetical model H1, H2, H3, H4, H5 and H6).

The following hypotheses were explored:

1. Compare the knowledge sharing behaviour of sport professionals with different behavioural intention models.

   Hypothesis 1: Sharing intentions directly affect sharing behaviour.
   Hypothesis 2: Knowledge sharing attitudes positively and directly affects the knowledge sharing intention.
   Hypothesis 3: Knowledge sharing subjective norms positively and directly affects the knowledge sharing intention.
   Hypothesis 4: Perceived knowledge sharing behaviour positively controls and directly affects knowledge sharing intentions.
   Hypothesis 5: Perceived control of knowledge sharing behaviour positively and directly affects knowledge sharing behaviour.
   Hypothesis 6: Knowledge sharing subjective norms positively and directly affects the knowledge sharing attitudes.

2. A comparison of the knowledge sharing behaviour models of sport professionals in different working fields.

   Hypothesis 7: Industry and the education sector have significantly different models of knowledge sharing behaviour.

METHODOLOGY

Subjects

The subjects of the study were professionals employed by Taiwan‟s sport, exercise, sport health, recreational sport and dance industries. The purposive sampling method was chosen and 1 200 questionnaires were issued. Six hundred and sixty-six (666) valid questionnaires were retrieved, which provided an acceptable retrieval rate of 55.50%. More males than females featured in the sample (61.6% and 38.4% respectively) and most participants were in the 21 to 30 year range, followed by the 31 to 40 range (61.6% and 38.4% respectively). The majority were graduates of vocational schools, followed by colleges (47.3% and 35.9% respectively) and employed in the industry sector, followed by academia (36.64% and 63.36% respectively). The percentage from the academic sector was comprised of people working in schools (14.11%), colleges (8.75%), and universities (40.54%). These physical education specialists were primarily involved in sport coaching, administration and sport science research.

Research tool

The development of the research tool was based on an examination of related literature and a published questionnaire (Ajzen, 2001b; Bock & Kim, 2002; Wu, 2003; Liu, 2006). The characteristics of the sport profession were also taken into consideration, and a 7-point Likert rating scale was applied to develop the *Sports Professional Knowledge Sharing Behaviour Survey Questionnaire*. This 6-part questionnaire was comprised of sharing attitudes, subjective norms, Perceived Behavioural Control (PBC), knowledge sharing behaviour and knowledge sharing intentions. After the questionnaire‟s initial draft was completed, 6 academics and experts from sport-related fields were invited to help ratify the validity of the questionnaire (expert validity). Sport professionals were then asked to test the questionnaire to clarify the subject‟s responses to the questions and to edit the questionnaire accordingly. One hundred and thirty nine (139) questionnaires were then

randomly drawn as test samples for item analysis and reliability analysis, and 527 questionnaires were selected for confirmatory factor analysis, to verify if each observed variable could effectively reflect its latent variable.

The item analysis was conducted on 139 test questionnaires. The item analysis results showed that every question reached significant variation (p=0.00), indicating each question had discriminate validity. Moreover, the Cronbach"s alpha value of each subscale was as follows:
0.87 for the „knowledge sharing attitudes" aspect, 0.84 for the „subjective norm" aspect, 0.87 for the „perceived behavioural control" aspect, 0.90 for the „knowledge sharing behaviour intention" aspect, 0.88 for the „knowledge sharing behaviour" aspect, and 0.92 for Cronbach"s total scale alpha value.

In summary, it showed that the content validity and questions in each aspect of the questionnaire were consistent, with all questions falling into the acceptable range. The confirmatory factor analysis was then conducted using AMOS 17. The results indicated that the model matched the goodness-of-fit evaluation indicators with: GFI (Goodness-of-Fit Index)=0.95; NNFI (Non-Normed Fit Index)=0.96; CFI (Comparative Fit Index)=0.98; CN (Critical N)=267; RMSEA (Root Mean Square Error of Approximation)=0.054. The observed

variable reliability (R^2) was between 0.50 and 0.83 and the latent variable construct reliability was between 0.84 and 0.90.

The observed variable validity value (λ) was between 0.71 and 0.91 and the latent variable average variance extraction (validity) was between 0.64 and 0.75 (Table 1). Each matched the reliability and validity indicator standard (Huang, 2004). Therefore, the reliability and validity of the scale was acceptable. Following that, a structural model and multiple group comparison were tested using the structural equation modelling method (Chen, 2007; Chiou, 2010).

***TABLE 1*: SUMMARY OF CONFIRMATORY FACTORY ANALYSES**

Item	**λ**	**R^2**	**Cronbach's alpha**	**Average variance**
Knowledge sharing attitudes			0.87	0.69
C1 Knowledge sharing is a good thing	0.87	0.75		
C2 Knowledge sharing is valuable	0.91	0.82		
C3 Sharing helps to maintain harmonious relationships with others	0.71	0.50		
Subjective norm			0.84	0.64
D3 Service institutions encourage knowledge sharing	0.72	0.51		
D4 The management believes I should provide knowledge	0.84	0.71		
D5 Colleague believes I should provide knowledge	0.83	0.69		
Perceived behavioural control			0.87	0.70

K2 Able to control whether to provide knowledge	0.83	0.69		
K3 Know which method to use to provide knowledge	0.89	0.79		
K5 Sufficient communication ability to share knowledge	0.78	0.61		
Sharing intention			0.90	0.75
B1 Willing to share knowledge	0.83	0.70		
B3 Intend to share knowledge	0.91	0.83		
B4 Try hard to share knowledge	0.85	0.73		
Sharing behaviour			0.88	0.71
A1 Share knowledge and experience often	0.84	0.71		
A2 Resolve professional issues for colleagues	0.87	0.76		
A3 Assist colleagues to find a resolution strategy	0.80	0.65		

Analysis of data

There are two ways to compare competing models: nested structure and non-nested structure. Nested structure imposes constraints on the non-constrained model by examining the discriminate validity and the difference of chi-square between the non-constrained model and the constrained model. There are two types of non-nested structure models. One type is having the same covariance matrix but different parameters. That is, the two models have the same items and dimensions but in different orders. The other model has a nested structure having neither the same covariance matrix nor the same parameters, with different models even having different survey items (Ha *et al*., 2010; Chang, 2011; Kline, 2011). This study compared the models developed on the basis of three different theories and the models among different professional groups. The former examines the fitness of models and the amount of explained variance (R^2), which are called model selection tests (Diamantopoulos & Siguaw, 2000; Chang, 2011). The latter compares path coefficients in both groups, using a multiple- groups or multi-sample analysis (Chen, 2007).

RESULTS

Comparison of sport professional knowledge sharing behaviour in different behaviour intention models

The Theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TPB) and the Modified Theory of Planned Behaviour (MTPB) models were utilised to explore the knowledge sharing behaviour of sport professionals. From the overall fit indexes of the investigated models in Table 2, it was possible to determine that the indexes of the 3 models all met the evaluation standard.

***TABLE 2*: OVERALL FIT INDEXES OF INVESTIGATED MODELS**

Fit index	Obtained value	TRA	TPB	MTPB
χ^2	–	146.29	201.42	233.69
df	–	50.00	82.00	83.00

GFI	0.9	0.96	0.95	0.95
AGFI	0.9	0.93	0.93	0.92
RMSEA	0.1	0.06	0.05	0.06
NNFI	0.9	0.96	0.96	0.96
CFI	0.9	0.98	0.98	0.97
PNFI	0.5	0.73	0.75	0.76
PGFI	0.5	0.61	0.65	0.65
CN	200.0	243.00	272.00	237.00
χ^2 /df	3.0	2.93	2.46	2.82

GFI= Goodness-of-Fit Index AGFI= Adjusted Goodness of Fit Index RMSEA= Root Mean Square Error of Approximation NNFI= Non-Normed Fit Index CFI= Comparative Fit Index PNFI= Parsimony Normed Fit Index PGFI= Parsimony Goodness of Fit Index CN= Critical N

This indicated that all 3 models could explain sport professionals‟ knowledge sharing behaviour. Nevertheless, a comparison of the index numbers found that the Theory of Planned Behaviour (TPB) model performed the best.

Regarding the path relationship among the dimensions in the 3 sharing behaviour models, a standardised coefficient was adopted for the path value to test hypotheses 1 to 6 in the research model (Table 3). Therefore, each hypothesis was verified and all were found to have a significant positive effect. To further explore the relationships between the 3 models in terms of knowledge sharing behaviour, the Theory of Reasoned Action (TRA) model was only affected by „sharing intention‟ (0.74). In the Theory of Planned Behaviour (TPB) and the Modified Theory of Planned Behaviour (MTPB) models, the „knowledge sharing intention‟ effect was the highest (0.56); followed by „perceived behavioural control‟ (0.28.). For the knowledge sharing intention, there was no perceived behavioural control variable in the TRA model; „attitudes‟ had the highest effect (0.43), followed by „subjective norms‟ (0.25). In the TPB and the MTPB models, the „knowledge sharing intention‟ was most affected by „perceived behavioural control‟ (0.39 and 0.40 respectively), followed by
„attitudes‟ (0.30 and 0.32 respectively) and „subjective norms‟ (0.13 and 0.12 respectively). In the MTPB model, the subjective norms also affected the „attitudes‟ (0.61).

***TABLE 3*: MODE OF HYPOTHESES AND PATH EFFECT**

Hypothesis	Path relationship	TRA	TPB	MTPB
H1	BI → BE	0.74*	0.56*	0.56*
H2	AT → BI	0.43*	0.30*	0.32*
H3	SN → BI	0.25*	0.13*	0.12*
H4	PBC → BI	–	0.39*	0.40*
H5	PBC → BE	–	0.28*	0.28*
H6	SN → AT	–	–	0.61*

AT=Attitudes Toward behaviour; SN=Subjective Norms; PBC=Perceived Behavioural Control BI =Behavioural Intentions; BE=Behaviour * $p<0.05$
TRA= Theory of Reasoned Action TPB= Theory of Planned Behaviour MTPB= Modified Theory of Planned Behaviour

In addition, a comparison of the explanatory power of the 3 models in terms of sport professionals‟ knowledge sharing intentions and behaviour, the TPB model was the most

effective for „knowledge sharing behaviour" (R^2=58%), followed by the MTPB model (R^2=57%). The TRA model had less explanatory capability (R^2=54%). With regard to
„knowledge sharing intention," the TPB model had the best explanatory capability (R^2=47%), followed by the MTPB model (R^2=45%) and the TRA model (R^2=37%). In conclusion, for sport professional knowledge sharing behaviour models, the Theory of Planned Behaviour model was the best overall.

Comparison of the knowledge sharing behaviour models of sport professionals in different occupational fields

Since the Theory of Planned Behaviour (TPB) model was the best at constructing sport professionals" knowledge sharing behaviour, it was used to explore sport professionals" knowledge sharing behaviour in different occupational fields. By means of a group mode, 210 people employed in academia and 217 employed in industry were selected from the sample. The indicator analysis results of the 2 groups showed that the model matched the goodness-of-fit evaluation indicator (GFI=0.92; NFI=0.93; CFI=0.97; CN=280;

RMSEA=0.044, $\chi 2/df$=1.81, meaning each met the standard). These results demonstrated the appropriateness of the multiple group sample data model.
To further explore whether there were any differences between industry and academia, 5 nested models established in AMOS were adopted as the method of analysis (Chen, 2007). The results of a comparison of the 5 aforementioned methods indicated how, under the same measurement path coefficient, the 2 groups did not show any significant differences, unlike the others (Table 4). Therefore, with the exception of the latent variables constructed by observed variables in industry and academia, significant differences were apparent.

***TABLE 4*: ANALYSIS OF MULTI-GROUP MODEL**

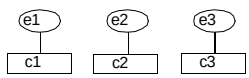
Model	df	χ^2	p
Measurement weights	10	12.79	0.24
Structural weights	15	28.55*	0.02
Structural covariance	21	39.60*	0.01
Structural residuals	23	41.51*	0.01
Measurement residuals	38	68.04*	0.00

* $p<0.05$

***TABLE 5*: PATH EFFECTS OF DIFFERENT GROUPS OF ACADEMIA AND INDUSTRY**

Path relationship	Total sample (N=527)	Multiple group Academia (n=210)	Industry (n=217)
AT → BI	0.30*	0.35*	0.24*
SN → BI	0.13*	0.32*	0.02
PBC → BI	0.39*	0.19*	0.48*
BI → BE	0.56*	0.64*	0.48*
PBC → BE	0.28*	0.18*	0.38*

* $p<0.05$



AT = Attitudes Toward behaviour SN = Subjective

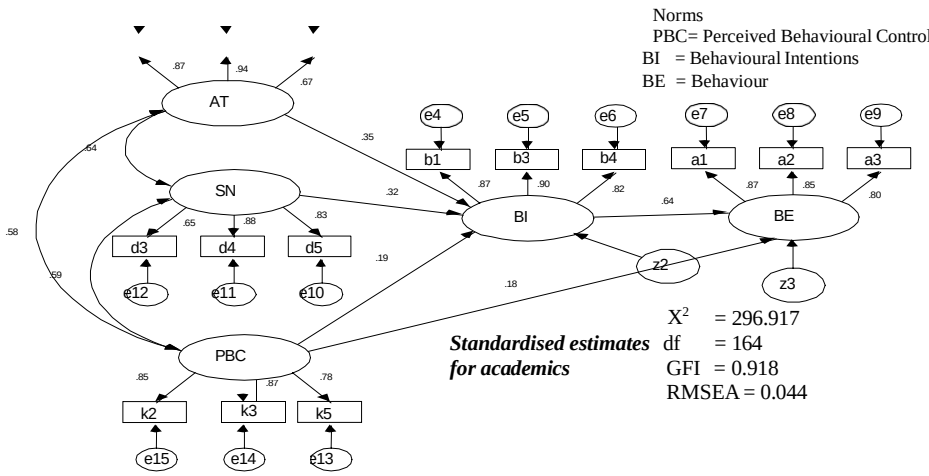
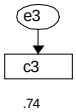


***FIGURE 2*: GROUP SHARING BEHAVIOUR MODEL FOR ACADEMIA**

.85

.91

AT


e3
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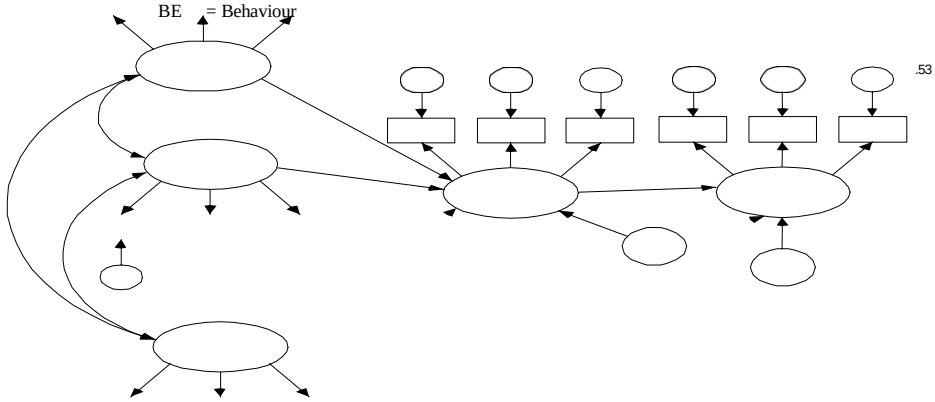
.74

AT = Attitudes Toward behaviour SN = Subjective Norms
PBC = Perceived Behavioural Control BI = Behavioural Intentions
BE = Behaviour



e4

.24

b1

e5 e6

b3 b4

e7 e8 e9

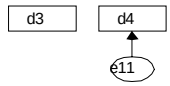
a1 a2 a3

.42

.48 z2

.38

.74



SN

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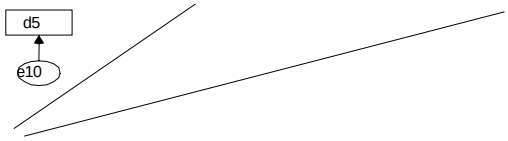

.02

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BI

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BE

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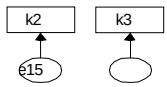
e12

z3

.86

PBC



.88

.76

Standardised estimates for academics

X^2 = 296.917
df = 164
GFI = 0.918
RMSEA = 0.044

***FIGURE 3*: GROUP SHARING BEHAVIOUR MODEL IN THE INDUSTRY**

With regard to the *sharing behaviour* model in academia and industry (Table 5, Figure 2 & Figure 3), all met the standard, except for the „subjective norms" of the industry behaviour mode. In terms of knowledge sharing intentions, in academia the „attitudes" mode had the highest effect (0.35), followed by „subjective norms" (0.32), while the „perceived behavioural control" had the lowest effect (0.19). In the industry mode, „perceived behavioural control" had the highest effect (0.48), followed by „attitudes" (0.24); with „subjective norms" having the lowest effect (0.02 did not reach significance). In terms of *knowledge sharing behaviour*, in both academia and industry, „knowledge sharing intention" had the highest effect (0.64 and 0.48), followed by „perceived behavioural control" (0.18 and 0.38). This showed that the knowledge sharing behaviours of academia and industry are indeed different. Therefore, Hypothesis 7 was confirmed.

DISCUSSION AND CONCLUSIONS

In terms of the related behavioural research literature, the Theory of Reasoned Action, the Theory of Planned Behaviour and the Modified Theory of Planned Behaviour were adopted to explore sport professionals" model of sharing behaviour. The goodness-of-fit indicator and explanatory capability of the three models were also compared to find the best sport professional behaviour-sharing model. Next, the path relations of different group models were compared to provide a reference that could improve sport professionals" sharing behaviour and enhances the effectiveness and knowledge value of the sport and recreation industry.

The goodness-of-fit indicators of the Theory of Reasoned Action model, the Theory of Planned Behaviour model, and the Modified Theory of Planned Behaviour model, all met the standard. Research hypotheses 1 to 6 were confirmed. The path relations of all the

dimensions showed a significant positive effect. With regard to sport professionals" knowledge sharing behaviour, the above results indicate that personal attitudes, an enhanced ability to judge one"s own capability, and gain support and encouragement, can increase one"s knowledge sharing behavioural intentions, which will in turn increase knowledge sharing behaviour. In other words, behaviour was affected by behavioural intentions, and behavioural intentions were affected by behavioural attitudes, subjective norms and perceived behavioural control. This finding is consistent with the results of other relevant research (Ajzen, 1985, 1991; Madden *et al*., 1992).

In addition, a comparison of the three models found that the Theory of Planned Behaviour model was more useful overall at providing a goodness-of-fit indicator. It also demonstrated a greater explanatory capability for knowledge sharing behaviours and intentions. The

Theory of Planned Behaviour has been generally regarded as the most developed behavioural intention model, and the results of this study confirm this status. Therefore, the Theory of Planned Behaviour is the best model for constructing sport professionals‟ knowledge sharing behaviour.

The Theory of Planned Behaviour model was used in this research to explore and compare the knowledge sharing behaviour of sport professionals in different fields. A comparison of industry and academia showed significant differences, except for the established measure path coefficient. This indicated that knowledge sharing behaviours are indeed different for industry and academia. The relevant variables in this respect were the nature of the industry, employment relations, organisational culture, partner relationships and organisational tasks. Each of these influences the knowledge sharing attitudes, subjective norms, perceived behavioural control and sharing behaviour of professionals in different occupational fields. These findings are comparable to previous research (Hendriks, 1999; Lee, 2001; Bock & Kim, 2002; Hansen, 2002; Liao *et al*., 2004). Hypothesis 7 was therefore confirmed.

In conclusion, the main finding was that the level of sharing behaviour by sport professionals in academia and industry was dependent on sharing intention and perceived behavioural control. Therefore, increasing sharing intention will increase sharing behaviour and perceived behavioural control influences sharing behaviour. This was more obvious in industry than in academia. Nevertheless, there was a significant discrepancy between academia and industry in terms of the variables that affect sharing intentions. The degree of sharing intentions among sport professionals in academia was dependent on the personal subjective opinion of the value of sharing. It was influenced by the relative amount of encouragement received from management and colleagues. For industry sport professionals, the level of sharing intention was conditional on the sharing ability of individuals and the subjective opinion of the shared value. In addition, in the industry sharing behaviour model, perceived behavioural control took on a very important role; this phenomenon may indicate that for those employed in the industry, knowledge sharing behaviour was a highly autonomous and subjective behaviour, and as such, was not easily influenced by its surrounding environment.

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Dr. Chin-Liang HO: Director, Department of Sports Taipei City Government, No.10, Sec.4, Nanjing E Road, Sungshan District, Taipei, Taiwan. Tel.: 886-2-25702330 (ext. 201), Cell: 886-988-579160, E- mail: masm@mail.npust.edu.tw

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BIBLIOMETRIC STUDY (1922-2009) ON RUGBY ARTICLES IN RESEARCH JOURNALS

Ignacio MARTÍN *; Jesús OLMO**; Luis J. CHIROSA***; David CARRERAS**** & Jordi SOLÁ*****

**Department of Methodology, Faculty of Psychology, University of Granada, Granada, Spain*
***Department of Rehabilitation & Sports Medicine, Quirón Hospital, Madrid, Spain*
****Faculty of Physical Activity and Sport Sciences, University of Granada, Granada, Spain*
*****National Institute of Catalonia for Physical Education (INEFC), University of Lleida, Lleida, Spain*
******National Institute of Catalonia for Physical Education (INEFC), University of*

Barcelona, Barcelona, Spain

ABSTRACT

The purpose of this research was to perform a bibliometric analysis of research journals containing scientific articles on the sport of rugby from 1922 to 2009. In this field 2057 articles were selected from major databases. The journals, authors and contents published were selected by taking into account the year of publication, thematic areas and modalities of rugby among other variables. A steady increase in production was found in the period considered, with a maximum of 174 articles published in 2007. The articles were written by an average of 2.5 authors and most of them (80.9%) only participated in one. The data showed a utility loss of 7.5% of the total items each year. The thematic areas and most influential journals on rugby had been identified. Finally, limited support has been found for attempting to adjust the bibliometric data by applying the laws of Lotka and Price with respect to the authors, and Bradford's law regarding scientific journals.

Key words: Rugby; Bibliometric study; Scientific literature; Bibliometric laws of Lotka and Price; Law of Obsolescence in scientific literature; Bradford‟s law.

INTRODUCTION

Since the birth of rugby in the 19th century in England, it has been steadily increasing its number of practitioners, today becoming one of the major team sports in the world. Rugby or rugby football (when referring to it generically), has been a sport subject to, like any other human activity, the vicissitudes of history. In this way there have been several methods that have evolved at different times. One example was the first differentiation that occurred with the clash between supporters of the defence of amateurism and supporters of accepting financial compensation. This resulted in the division of Rugby football into two codes: XV Rugby or Rugby Union and XIII Rugby or Rugby League, which have since been separated organisationally (Sheard, 1997).

The body responsible for the Rugby Union is the International Rugby Board (IRB) with an estimated three million members in its sport federations belonging to 98 federation members and 18 federation associates (IRB, 2009). During 2009, it received a new impetus with the inclusion of „Sevens‟ as a new Olympic sport. Rugby was already an Olympic sport, but in the form of XV Rugby at the games held in London (1908), Antwerp (1920) and Paris (1924). Other important milestones that can be considered momentous in the development of the sport have been the first Rugby World Cup that took place in New Zealand in 1987 and the recognition of rugby‟s professional sport status in 1995 (McMillan, 2006; Williams, 2008).

Rugby League is played in countries like Australia, New Zealand, France, Russia, Wales, Scotland, Ireland, England, Papua New Guinea, Fiji, Samoa and South Africa. In 2008, the latest edition of the Rugby League World Cup was held in Australia, and its next edition is scheduled for 2013 in the UK. The other most widespread form of rugby is Sevens. This

variant originated in Melrose (Scotland) in 1883, but did not become popular until the 1920‟s of the 20th century. Sevens had a major boost in the 1990‟s with the birth of the World Series and now with its inclusion in the 2016 Olympics to be held in Rio de Janeiro. With the approval of the International Olympic Committee (IOC), since the Athens Paralympics in 2002, Quad Rugby (wheelchair rugby) has been developed, which had its origins in Canada in 1976.

There are other types with more applicable functions in the fields of recreation and education, such as tag rugby (or flag rugby), touch rugby, beach rugby and underwater rugby, amongst others. However, this social development has not had an equal impact on research into sport (Mellalieu *et al*., 2008). According to these authors, there are some articles that deal with the rugby union in scientific literature, mainly from the medical perspective of injuries, rather than epidemiological studies or case studies. These authors also classified the remaining articles into four major areas: performance; physiology; psychology; and biomechanics.

Gabbett (2005) completed a review of rugby league and scientific research. The areas highlighted were anthropometry and physiology, psychology, epidemiology of injury, training and strength and performance analysis. Several scientific articles have included bibliometric studies in the field of sport and physical activity.

Bibliometrics is the name given by library and information science to the study of patterns of publications (Hawkins, 1977; Diodato, 1994). Bibliometrics is used to examine scientific productivity as classified by author, journal, discipline, affiliation, etc. A bibliometric researcher is able to identify the attributes that make a specific body of literature unique from others. Bibliometrics dates back to the 1900s (Cole & Eales, 1917), and is governed by several laws and principles (Bradford‟s law of scattering and Lotka‟s or Price‟s law relating to patterns of citation).

At first, Lidor *et al*. (1999) studied whether there was an increase in the number of scientific publications related to aging and physical activity in adults. Based on data collected from *Sport Discus* and *MEDLINE* from 1973 to 1997, comparisons were made of publications focusing on aging and physical activity in relation to publications in the area of physical activity along with the published totals. This relationship was likewise studied in six

scientific journals, which concluded that the interest of researchers in sport science and exercise does not correspond with increases produced in this period in society regarding the adult population.

The second bibliometric study was undertaken by O‟Connor *et al*. (2001), which focused on the teaching area of adapted physical activity (APA). A sample of 770 articles from 259 scientific journals was researched from 1988 until 1998 by accessing *Article First, ERIC, MEDLINE* and *Sport Discus* databases. The results indicated that 1 720 authors, of whom only 11 contributed four or more articles, submitted publications. They also investigated the adjustment of the data by applying different bibliometric laws, such as Bradford‟s law, Lotka‟s law or Price‟s law. Bradford's law states that journals‟ research articles can be grouped in different categories according to the number of publications in this area.

In the current study, the literature on APA pedagogy was distributed in four areas, with 4, 15, 64 and 176 journal articles in each of these areas respectively. This was approximately the same amount of articles, which supports Bradford‟s law. Lotka‟s law and Price‟s law allows relating the number of articles to the number of authors. For example, it can be calculated by a formula where 50% of the papers published during a given period will be produced by 10% of the active publishing scientists. However, there was no evidence in favour of Price‟s law, since most authors only contributed one article. They also highlighted the four publications that have made the most contributions in this area and form the important core of the creating articles on APA pedagogy.

In the field of sport psychology, Baker *et al*. (2003) published an investigation that examined whether the research articles published in the field of sport psychology followed the law of Lotka and Price. They studied the authors who had published articles in five journals in sport psychology from 1970 to 2000. The results provide some support for the bibliometric laws studied. However, they deducted that the field of sport psychology is less elitist than other disciplines because there is a greater dispersion in the number of authors who have access to publish in scientific journals. Finally, in the related area of athletic training, Delwiche and Hall (2007) identified the major databases and journals in this field by studying the references of the three major journals in the area between 2002 and 2004. After applying Bradford‟s law, they identified six primary journals and 40 at a more secondary level.

Bibliometric articles have also been written about scientific journals in the area of sport like those published by Heinemann and Preuss (1990) in the *International Review for the Sociology of Sport*, Reid and Broadhead (1995) in the *Adapted Physical Activity Quarterly*, Thompson (1996) in the *British Journal of Sports Medicine*, Ward and Ko (2006) in the *Journal of Teaching in Physical Education* and recently, Arbinaga *et al*. (2010) in the *Journal of Sport Psychology*. Other bibliometric studies on sport, although about other types of publications, have been of, for example, doctoral dissertations on sports science in Turkey (Yaman & Atay, 2007), or on martial arts case studies published in Spain (Perez & Gutierrez, 2008).

PURPOSE OF THE STUDY

The objective of this research was to conduct a bibliometric analysis of research journals containing scientific papers on rugby from 1922 to 2009. This analysis involves studying the journals, authors and content of articles taking into account the years of publication, thematic areas and modalities of rugby, among other variables. It also seeks to establish whether the bibliometric laws of Lotka and Price are fulfilled in this area with respect to the authors‟ obsolescence in relation to the years of publication and Bradford‟s laws in relation to the journals where the articles were published. Thus, this article attempts to provide an overview of the scientific production of articles on the sport of rugby.

METHODOLOGY

The first step in a bibliometric analysis is to select the key word or words for the search (Lidor *et al*., 1999; O‟Connor *et al*., 2001). In this study it was accepted that the word

„rugby" designates a set of modalities of sport or sports (Rugby Union, Rugby League, Rugby Seven, Quad Rugby, etc.), and that it is spelled the same in the main languages in which the major research journals are written.

The search was restricted to articles in scientific journals (including research and review articles and editorial statements), compared to other types of publications that were rejected (books, Internet-based resources, symposia, presidential addresses, abstracts associated with conference proceedings, unpublished reports, theses, dissertations, conference proceedings, poster presentations, book/video reviews, government documents including federal and state laws, interviews, emails, patents, and other items).

The search was conducted in 3 databases: Scopus, ISI Web of Knowledge (MEDLINE is included) and Sports Discus. Sport Discus and ISI Web of Knowledge were selected because they have been used in all previous studies on sport bibliometrics. Scopus were added as the current largest database of abstracts of the world, with 13 450 publications from more than 4 000 international publishers. The fields in which the search was delimited included the article title, the summary and key words. In the ISI Web of Knowledge database there were 1 395 references, in Scopus, 1 586 and Sports Discus, 1 830 under these criteria. In each of these, the references were exported and then imported to the RefWorks program (Refworks- ProQuest, version 2008).

A total the 4 811 references were stored in a folder and filtered. Firstly, duplicate references were removed, as well as those that did not have at least one identifiable author. After this initial filter there were 2 911 references. Subsequently, each reference was individually studied, citing the word „rugby" (referring to the sport) in the title, key words or abstracts. After this second filter, 2 057 articles were selected that constitute the sample for this bibliometric study. References from RefWorks were exported to enter the data into Excel and SPSS programs that performed statistical calculations and produced the graphics.

RESULTS

Study of the authors

The 5 186 authors wrote 2 057 articles so that each article was written on average by 2.5 researchers. The place of writing of each author was not taken into account. A total of 3 604 authors were included and the distribution of their contribution to scientific knowledge of rugby is shown in Table 1. It is noteworthy that 80.9% of the authors contributed only one article and 10.8% contributed only two.

***TABLE 1*: PRODUCTIVITY OF THE AUTHORS**

Number of articles	*Number of authors*	*Number of contributions*	*% Number authors*
1	2916	2916	80.91%
2	389	778	10.79%
3	138	414	3.83%
4	57	228	1.58%

5	33	165	0.92%
6	21	126	0.58%
7	12	84	0.33%
8	7	56	0.19%
9	3	27	0.08%
10	5	50	0.14%
11	3	33	0.08%
12	6	72	0.17%
13	4	52	0.11%
14	1	14	0.03%
15	3	45	0.08%
16	2	32	0.06%
17	1	17	0.03%
18	1	18	0.03%
22	1	22	0.03%
37	1	37	0.03%
Total	3604	5186	100%

It can be seen that the 10 most prolific authors have written more than 14 articles each, possibly highlighting the rugby code in which they research, the years in which they were published and the affiliation of the author (Table 2). For a further analysis of the authors in a study area, the bibliometric laws of Price and Lotka were applied.

Price‟s law indicates that success leads to success, in terms of productivity in the number of articles by several authors (Price, 1963). It was also Price who concluded that half of the

literature produced in a given field will be carried out by the square root of the total number of authors publishing in that field. In this study, the square root of 3 604 is 60.03 authors that have generated a maximum of 619 articles. This result differs from that established by Price‟s law, which would be half of those studied: 2 057/2=1 028.5.

***TABLE 2*: MOST PRODUCTIVE AUTHORS**

Author	No. articles	Type	Year of publication	Affiliation
Gabbett, Tim J.	37	RL	2000-2009	Queensland Academy of Sport, AU
Chalmers, David J.	22	RU	1991-2009	Dept. of Preventive and Social Medicine, Univ. of Otago, NZ
Noakes, Timothy D.	18	RU	1983-2008	Dept. of Human Biology, Univ. of Cape Town, Sports Science Inst. of South Africa, RSA

Lac, Gerard	17	RU	2000-2008	Laboratoire de physiologie de la performance motrice, FR
Quarrie, Ken L.	16	RU	1995-2009	NZ Rugby Union, Inst. of Sport & Recreation Research, AUT Univ., NZ
Scher, A.T.	16	RU	1981-1998	Dept. of Radiology, Tygerberg Hospital & Univ. of Stellenbosch, RSA
Hopkins, Will G.	15	RU	2005-2009	Auckland Univ. of Technology, Inst. of Sport & Recreation Research, NZ
Kemp, Simon P.T.	15	RU	1999-2008	Rugby Football Union, Twickenham, UK.
Nauright, John	15	RU & RL	1990-2007	Dept. of Human Movement Studies, Univ. of Queensland, AU
Brooks, John H.M.	14	RU	2005-2008	Rugby Football Union, Twickenham, UK.

RL = Rugby League RU = Rugby Union
AU = Australia FR = France NZ = New Zealand RSA = Rep. of South Africa UK = United Kingdom

For its part, Lotka"s law (Lotka, 1926), established a relationship between authorship and the number of publications. Thus, the relationship between the frequency of a group of people (y) who carry out a number of defined contributions (x) is constant according to the equation:

$$y_x = c * x^{-n}$$

In the current study and after following the proposed methodology for calculating the n and c constants of the previous equation (Pao, 1985; Nicholls, 1986; Pulgarín & Gil-Leiva, 2004), the result would be:

$$y_x = 0{,}7711 * x^{-2{,}6123}$$

Having established the parameters of the equation, it can be determined if the theoretical data predicted in it, fit the empirical data and then it can be decided whether the set of publications in Rugby followed the Law provided by Lotka. To study the adjustment of the empirical to the theoretical distribution, the Kolmogorov-Smirnov test was performed (Pao, 1985). To do this, the maximum difference among the differences in observed and predicted accumulated observations were compared with the critical value. Here the maximum difference was 0.0380, which was higher than critical value of 0.0272, indicating significant differences (p= 0.01) between the two distributions.

Study descriptors and themes

Study descriptors (key words for each article) can also be investigated. Of the 2 057 articles studied, key words were registered in only 1 371. The most utilised were rugby football, wounds and injuries and rugby union football (Table 3).

***TABLE 3*: MOST FREQUENT DESCRIPTORS**

Descriptors	Frequency
Rugby football	483
Wounds & injuries	345
Rugby Union football	336
Rugby	297
Rugby League football	169
Sports	159
Athletes	135
Males	127
Rugby football players	115
New Zealand	104
History	100

However, these descriptors do not give a clear picture of the contents. In order to explain this idea, the analysis was based on a set of terms in major fields of the records in each group for all the articles. In principle, the rules or terms relating to rugby was analysed. It was found that the term „rugby‟ appeared in 2 012 articles (97.8%), Rugby Union in 542 (26.4%), Rugby League in 297 (14.4%) and both terms were found in 60 (2.9 %). Other modalities have been studied, namely wheelchair rugby or quad rugby (25; 1.2%), Rugby Sevens (3; 0.2%) or Underwater Rugby (2; 0.1%).

With the analysis of the topics, the most discussed topics concerns injuries (727; 35.2%) followed by those dealing with training (318; 15.5%), performance (314; 15.3%), history (247; 12.0%), strength (160; 7.8%), psychology (130; 6.3%), management (121; 5.9%), anthropometry (109; 5.3%), physiology (107; 5.2%), sociology (72; 3.5%) and biomechanics (45; 2.2%). Regarding the countries, the most productive country is Australia (185; 9.0%), followed by New Zealand (174; 8.5%), England (116; 5.6%), South Africa (84; 4.1%), Wales (43; 2.1%), Japan (36; 1.8%), United States (30; 1.5%), France (29; 1.4%), Ireland (19; 0.9%) and Scotland (16; 0.8%).

Study of the publication years

The publication of rugby articles in scientific journals has had a steady increase since it was launched in the 1960‟s. Thus, in the decades of the 1920‟s, 30‟s, 40‟s and 50‟s, the averages were 0.4, 0.1, 0.3 or 0.4 respectively. An increase occurred in the decades of the 1960‟s through to 2000, with an average of 1.5, 9.1, 30.7, 50.6 and 112.6. This pattern may be observed in Figure 1.

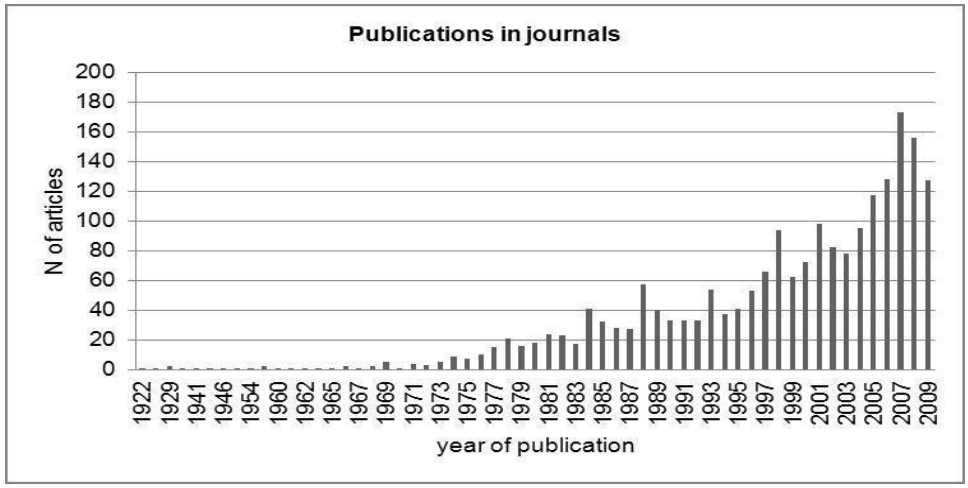

***FIGURE 1*: PUBLICATIONS BY YEAR OF RUGBY ARTICLES IN SCIENTIFIC JOURNALS**

The obsolescence or disuse of a group of articles was also studied. Obsolescence means the temporary decline in value of a measure or validity of information. Burton and Kebler (1960) introduced the concept of „half-life" into the field of information science, finding that the half-life of the references in the journals of various sciences depends on the topical area concerned. Brookes (1970) established a mathematical law to measure the temporary loss of use of a set of documents from the average life (h). The Brookes equation states:

$$a = e^{(\ln 0{,}5)/h}$$

From the data of this study, the value can be estimated of **h**= 8.8 and thus the value of **a** (annual age factor) will be:

$$a = e^{(\ln 0{,}5)/8{,}8362} = 0{,}9246$$

So the annual aging factor is 92.5% or, expressed in another way, a current annual loss of 7.5%. It can also be stated that every 9 years (approximately 8.8362) the usefulness of the publications is reduced by 50%.

Study of scientific journals

The 2 057 articles dealing with rugby have been published in 631 journals, of which 421 have only published 1 article on this subject. Bradford (1934,1948), proposed a law to describe the distribution of a subject in a set of scientific journals. According to this author, the journals could be divided into 3 zones, each with the same number of articles, and the number of journals and the number that increased geometrically. Also, the distribution of journals according to their productivity presented a different model of concentration and dispersion when it was represented as a statistical distribution, with a larger group forming

a long tail of less productive journals.

Several authors have expressed these ideas mathematically (Leimkuhler, 1967; Brookes, 1969; Rousseau & Leimkuhler, 1987; Egghe, 1990; Rousseau 1994). Thus, to determine and verify the number of zones, the Bradford multiplier ***k*** needs to be calculated:

$$k = (e^{\gamma}\, Y_m)^{1/P}$$

Here γ is Euler's number (0.5772) and Y_m is the number of articles published in the most productive journals. Thus:

$$k = (1{,}781 * 175)^{1/3} = 6{,}78$$

The average of ***k*** is equal to 6.19 which are similar to that obtained in the equation. This is similar with each value of ***k***, showing a distribution in the 3 zones (Table 4).

***TABLE 4*: ZONES PROPOSED BY BRADFORD'S LAW**

Zone	No. of Journals	No. of Articles	*k*
1	14	677	
2	83	692	83/14 = 5.93
3	534	688	535/83 = 6.45
TOTAL	631	2,057	

The similarity of the different values of ***k*** and differences between these and the calculated Bradford multiplier k (6.78), clearly shows that the distribution fits a 3-zone of Bradford"s law. Likewise, the equation established by Bradford is:

$$R(r) = a \ln(1 + br)$$

Here ***R(r)*** is the cumulative number of articles produced by the journals of rank *1; 2; 3*, where *r*, y *a*, y *b* are constants. Following the methodology proposed by Pulgarín and Gil-Leiva (2004), for the data in this study, the equation would have the following values:

$$R(r) = 359{,}456 \ln(1 + 0{,}151\, r)$$

***TABLE 5*: JOURNALS AND ARTICLES OF ZONE 1 OR CORE**

	JOURNAL NAME	Published articles
1.	British Journal of Sports Medicine	175
2.	Journal of Sports Sciences	84
3.	Journal of Strength & Conditioning Research	61
4.	International Journal of the History of Sport	55
5.	Journal of Science & Medicine in Sport	41

6.	American Journal of Sports Medicine	33
7.	Sports Medicine	33
8.	Italian Journal of Sports Traumatology	30
9.	Science & Sports	30
10.	South African Medical Journal	30
11.	Sporting Traditions	30
12.	Clinical Journal of Sport Medicine	27
13.	International Review for the Sociology of Sport	25
14.	Journal of Sports Medicine & Physical Fitness	25

Using Lotka's law, one can check whether the empirical data matches the data proposed by the theoretical equation to determine if there is a good fit between the two. To check whether the data conforms to Bradford‟s law, several tests have been proposed. First, it must be confirmed that A/m>z/2, where A/m is the number of articles in the nucleus and z is the number of journals contributing only one article. In this study, A/m is 679 and z = 175. The inequality is obviously demonstrated in the data.

Another possibility to apply to check the fit is the Kolmogorov-Smirnov test. The maximum difference among the differences in the observed and predicted accumulated observations, were compared with the critical value. The maximum difference was 0.2585, which was greater than the critical value of 0.0300. There was a significant difference (p=0.01) between the two distributions. According to this test, the empirical data does not follow Bradford‟s law.

DISCUSSION

This study was conducted to determine the current status of research through the analysis of scientific articles related to a global sport, namely rugby. This study covers a larger number of references (2 057) than most of the bibliometric studies published. Baker *et al*. (2003) worked on a similar study with 2 417 articles, but it was limited to one type of publication, similar to the studies of Lidor *et al*. (1999), O‟Connor *et al*. (2001) and Valcarcel *et al*. (2010). The sources of information in which the searches have been carried out were by

means of the databases used by, for example, Lidor *et al*. (1999), Reid and Prupas, (1998), O‟Connor *et al*. (2001) and Yaman and Atay (2007).

As for the topic, the study is the only one that has focused on scientific articles in a particular sport. Other authors have made bibliometric studies on other topics, such as physical activity and aging (Lidor *et al*., 1999), sport disability (Reid & Prupas, 1998), adapted physical activity (O‟Connor *et al*., 2001), sport psychology (Baker *et al*., 2003), a scientific journal about a specific area (Heinemann & Preuss, 1990; Thompson, 1996, Ward & Ko, 2006) or a topic such as athletic training (Delwiche & Hall, 2007).

Concerning the number of authors, there was an average of 2.54 signatures per article, similar to the 2.53 found by Arbinaga *et al*. (2010) and the 2.5 of Valcarcel *et al*. (2010),

and similar to the average values between 1.91 and 2.54 obtained in the six journals that Baker *et al*. (2003) investigated. To this effect, other studies have reported that the number of articles with one author has changed from the majority (O‟Connor *et al*., 2001), 51% (Reid & Broadhead, 1995) or 75% (Heinemann & Preuss, 1990).

In terms of scientific productivity per author in a certain area, it was found that most authors only contributed one article. In this investigation, 80.9% of the authors only made one contribution of all the articles surveyed. These results are similar to those found by Baker *et al*. (2003), who found in the six journals studied, a percentage between 71.6 and 81.9% of the authors with a single contribution, which is below the 86% found by Thomson (1996).

Another way to evaluate the productivity of authors in a given field of study is to divide them into three groups and estimate the percentage in each of them. Baker *et al*. (2003) estimated that producers could be classified into three categories: high, if they produce more than 10 articles; medium, three to nine; and low, if they produce one or two articles. The data found by Baker *et al*. (2003) indicates percentages of 2.7%, 13.5% and 83.8% for high, medium and low, respectively. In the current study the percentages were 0.8%, 7.5% and 91.7%.

The lack of support for Price‟s law is consistent with those found by O‟Connor *et al*. (2001). In both cases the square root of the total number of authors has failed to generate half of the scientific productions, since in the case of the current study, a maximum of 30.1% was generated. This is in agreement with the data found by Baker *et al*. (2003). In another formulation of Price‟s law, Baker *et al*. (2003) found that 10% of the authors only generated 44% of the scientific productions, which is less than half. The current data indicates that 10% of the authors (36) generated a maximum of 22.3% of the publications.

No evidence was found to support the adjustment of the data in the current study for Lotka's law based on the calculation proposed by Pao (1985), Nicholls (1986) and Pulgarín and Gil-Leiva (2004). Thus, this field is less elitist than other areas of knowledge. Topics included in these research papers have been varied and although difficult to structure the topic from the key words, it was more enlightening when the search included words in the articles (in the title, key words or abstract). As has been already noted in the review of rugby union by Mellalieu *et al*. (2008) and rugby league by Gabbett (2005), most literature has addressed or is related to the study of injuries, probably because sport medicine literature has traditionally been dominant. Other issues have also been widely documented: training, performance,

history, strength, psychology, management, anthropometry, physiology, sociology and biomechanics.

Considering that rugby is a global sport with different codes, most of the scientific articles are focused on rugby union, followed by rugby league. In terms of the rugby codes, as often happens in a global sport, rugby union is the one that has occupied more articles followed by rugby league. It is noteworthy that a significant number of articles (60) included both types. The other variants of rugby have had little or sparse dissemination in scientific literature, with particular emphasis on the few studies related to „Sevens‟.

As for the countries represented by the authors of the articles, they coincide with those in which rugby is strongly entrenched since the late 19th and early 20th centuries. Specifically confined to Anglo-Saxon countries together with France and others in which, despite rugby being played less, there is a high scientific development and they have many publications, such as the US or Japan.

Focusing on the years of publication of the articles studied, its growth has been steady, with 2007 being the year that reached the maximum number of publications, with 173 articles. As far as the aging factor and average life, other studies were not found that address the area of Physical Education and sport. In other areas, several authors have found aging factors ranging from 0.9 in Sociology, 0.981 in History (Sangam, 1999), the 0.95 automatic indexing of the literature (Pulgarín & Gil-Leiva, 2004); and as for the average life values, between three for genetics and 6.6 in sociology, to 36 in music theory and 37 in history (Diodato & Smith, 1993; Sangam, 1999).

Finally, the study of the journals in which the articles have been published has enabled establishing, under Bradford‟s law, three zones that include every publication, including the main zone to the 14 most important journals (representing a total of 2.22% of the journals studied), that publishes scientific articles related to rugby. O‟Connor *et al*. (2001) in the area of adapted physical training identified four zones and the main zone included four journals (1.54%). For its part, Delwiche and Hall (2007) divided the articles in their study of athletic training into three zones and found six journals in the main zone (0.6% total). Of the 14 journals included in zone 1, seven had ratings above the average impact of all the journals in the area of sports science in 2006, where the ratings ranged between 3504 and 1212 (Tsigilis *et al*., 2010).

The adjustment to Bradford‟s law has been limited. Thus, the value adopted by the constant ***k*** of Bradford, supports an adjustment to this law. However, data from this study did not conform to this equation, as shown by the Kolmogorov-Smirnov test.

In summary, it can be concluded that the articles published on Rugby are written by an average of 2.5 authors and that only 8.3% of them have written more than two articles in this field. This supports the idea that there are a limited number of authors who published a number of articles and the majority published only on one or two occasions. However, the data findings did not provide support for Price and Lotka‟s laws. Gabbett in Rugby League and Chalmers in Rugby Union were found to be the most prolific authors, the descriptors of Rugby football and wounds and injuries were the topics most addressed, and Australia, New

Zealand, England and South Africa as the countries represented by the publications. Regarding publication years, there has been an increase since 1922, and most articles were published in 2007. A study of obsolescence established that every nine years or so, 50% become outdated. Finally, applying Bradford‟s law, 14 journals were identified where more has been published about Rugby, which can be considered as the core. The journal that has published the most scientific articles about Rugby is the British Journal of Sports Medicine.

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Dr. Ignacio MARTÍN: Department of Methodology, Faculty of Psychology, University of Granada, Granada, 18071 Granada, Spain. Tel.: +34 958249592, E-mail: imartin@ugr.es

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DOMINANT LIMB ASYMMETRY ASSOCIATED WITH PROSPECTIVE INJURY OCCURRENCE

Peter S. MAULDER
School of Sport & Exercise Science, Waikato Institute of Technology, Hamilton, New Zealand

ABSTRACT

The purpose of the study was to identify associations between dominant lower limb asymmetry in unanticipated agility performance and prospective injury occurrence. Female netball players (N=24) performed unanticipated 180° turn agility sprints on both the dominant and non-dominant legs interspersed with an additional straight running (no turn) task (5 trials per task), which were cued randomly using a visual monitor in the gait laboratory. A symmetry index was calculated for turn performance time over 2m for each netballer. Netball players were contacted regularly throughout the following six-month period for verification of any lower extremity injury experienced during their netball season. Pearson correlation coefficients with 90% confidence intervals were used to identify any associations between dominant limb asymmetry of greater than 10% for unanticipated agility performance and injury occurrence. Lower limb injury occurred in 37.5% (n=9/24) of the netball players. All injuries (100%) occurred in the netballer's dominant leg. A dominant limb asymmetry of greater than 10% in performance was identified for 57% (4/7) of the injured netball players and 14% (1/7) of the non-injured netball players. A moderate association of r=0.45 (90% CI: -0.01 to 0.75) was identified between dominant limb asymmetry of greater than 10% and injury occurrence.

Key words: Limb dominance; Turning performance; Prospective design; Netball.

INTRODUCTION

In New Zealand and Australia, netball is considered the primary team sport played both recreationally and competitively by females (McManus *et al.*, 2006). Netball is a high-strategy sport that requires the precise execution of technical motor skills with and without the ball, as well as the application of tactical knowledge when making decisions during many explosive sprints, abrupt stops, change of direction and landing movements (McManus *et al.*, 2006; Bock-Jonathan *et al.*, 2007). Given the physical demands of netball, there is a heightened risk of injury (Hume & Steele, 2000) and thus a need to better appreciate the risk factors involved.

Limb dominance is considered a risk factor for lower extremity injury because most athletes place a greater demand on their dominant limb (Beynnon *et al.*, 2002). Thus an increase in unilateral demand may lead to a functional asymmetry in motor ability (Haaland & Hoff, 2003). The presence of functional asymmetry due to limb dominance may be one of the factors responsible for mechanical overload affecting movement technique (Maupas *et al.*, 2002). Additionally, the dependence on the dominant limb can increase stress on the joints of that extremity (Murphy *et al.*, 2003), because it is preferentially used for jumping, landing or

pushing-off tasks (Murphy *et al.*, 2003; Negrete *et al.*, 2007). This can lead to an increased strength level, which may correspond to an increased frequency and magnitude of forces about the knee and ankle, particularly during high-demand activities (Beynnon *et al.*, 2002), which may increase the likelihood of injury (Negrete *et al.*, 2007). Research has identified an association between limb dominance and injury (Ekstrand & Gillquist, 1983; Chomiak *et al.*, 2000; Orchard, 2001), particularly for ankle and knee related injury occurrences. Such

injuries are common in court sport, such as netball (Hume, 1993; Hume & Steele, 2000), and are also more likely to occur in females compared to males (Hutchinson & Ireland, 1995; Ireland, 1999; Griffin *et al.*, 2000).

With regard to a functional difference threshold between limbs, it is empirically unknown what an acceptable difference is for an individual to exhibit in motor function. Epidemiological studies have speculated that side-to-side (e.g. dominant to non-dominant) functional asymmetries greater than 10% may further heighten the risk of injury (Burkett, 1970; Knapik *et al.*, 1991). However, to date there is no published research that has validated the surpassing of such a threshold (>10%) in relation to injury occurrence prospectively.

PURPOSE OF THE STUDY

The purpose of this study was to identify an association between dominant lower limb asymmetry of greater than 10% in unanticipated agility performance and prospective injury occurrence. In accordance with the literature reviewed, it was hypothesised that players exhibiting a dominant lower limb asymmetry of greater than 10% would be more likely to obtain a lower extremity injury.

METHODOLOGY

Participants

Twenty-four female netball players (mean±SD: age 21.6±3.2 years; height 1.75±0.07m; mass 74.4±11.6kg) volunteered to participate in this study. All netball players had at least 9 years of netball playing experience (13.1±2.6 years) and were in their pre-competition phase, which consisted of 1 to 7 (5.4±1.5) training sessions at a total of 2 to 10 training hours (8.8±2.3 hours) per week during data collection. The players recruited for this study were of national and regional representative level. All netball players had no history of a significant lower extremity injury 6 months prior to testing and were injury free at the time of data collection. Each netballer gave informed consent in writing to participate in this study prior to testing. Ethical approval was obtained for all testing procedures from the University Ethics Committee. All netball players wore spandex shorts or pants and ASICS (Gel-Rocket) court shoes during the data collection.

Netball player limb dominance

Limb dominance was determined via verbal questions and practical tests. The netball players were asked which leg was preferred for kicking a ball, and hopping on, with the preferred leg being considered the dominant leg (Maulder & Cronin, 2005). Furthermore, additional tests were used to identify which limb moved first, namely walking from a stationary position and

stepping off a 0.3m high step from a stationary position. The limb that moved first was considered the dominant limb. This information in conjunction with the question data allowed for a comprehensive decision to be made on limb dominance. The dominant limb was determined as the limb on the side of the body that was identified in the four

assessments the majority of the time.

Unanticipated straight-run task and unanticipated 180°-turn tasks

All testing was performed in a motion analysis laboratory. The netball players performed three tasks from a 10m approach that utilised a self-selected start stance: a left leg plant and 180°-turn; a straight ahead run; and a right leg plant and 180°-turn. The tasks were presented as options in order to obtain an unanticipated/decision made movement response, which have been demonstrated to elicit up to 2 times greater knee varus/valgus and internal/external rotation joint moments than anticipated movements (Besier *et al.*, 2001). Unanticipated movements may offer a better reflection of the loads experienced around lower extremity joints during a sporting scenario, as movements during game situations are generally not always anticipated due to an external stimulus (Besier *et al.*, 2001). Therefore, a visual cue was displayed on a 22-inch computer screen (Phillips 220BW, Phillips, China), which was triggered manually when the netballer was approximately 1m away from the target area. The screen was placed 0.5m to the right side of the target area. Testing tasks were assigned a colour consisting of green, yellow and red, which represented the 180° left leg plant and turn, straight ahead, and 180° right leg plant and turn respectively. Visual cues were created and presented using PowerPoint (Microsoft, Office, version 2003, California) slides.

Following a standardised warm-up that included 5 minutes of treadmill running and dynamic stretches of the lower extremity, several pre-planned and unanticipated trials of each task were performed before data collection started in order to provide the netball players with the opportunity to familiarise themselves with the testing tasks. Each netballer completed all 3 tasks randomly, as cued by the computer monitor. A total of 5 successful trials per turning task were needed for data analysis. A maximum of 30 trials were completed by the participants to acquire the required data set for 5 left leg plant and 180°-turns and 5 right leg plant and 180°-turns. No feedback on trials performed previously in the testing session was provided to the participants so as to avoid the possibility of the trials becoming planned.

A 180° left (or right) leg plant and turn trial was deemed successful if: (a) the approach speed fell between 3.5 and 5 $m.s^{-1}$; (b) the left (or right) foot came in contact with the turn area; and
(c) the exit speed was between 2.5 and 3.5 $m.s^{-1}$. The turning tasks were utilised in this study due to the use of the movement in field test assessment for the sport of netball. Specifically, the 505-assessment (180°-turn) was utilised to assess an individual's change of direction ability. Furthermore, anecdotally this type of turn is frequently utilised in netball. The approach and exit speeds were based on unpublished field-testing scores typical in sprint and agility assessment of New Zealand netball players. Each netballer was given approximately 45-90 seconds of rest between trials so as to reduce the potential effects of fatigue.

A two gate SWIFT® speed timing light system (SL-OPT180, SWIFT, Australia) was used to measure/monitor approach, performance and exit velocities. One timing light gate consisted of a dual beam modulated visible RED light sensor/reflector set up collecting at 4MHz

±80Hz. The timing lights were set at a height of 1.1m and placed parallel to the approach runway with 1 gate located 3m prior to the target area and the other located 1m prior. Thus 2m turning time was utilised as the turning performance outcome. Performance scores for left and right turns were then normalised to represent the participant's dominant or non-dominant limb.

In order to determine differences between limbs, a symmetry index score was calculated utilising the 2m turning performance on the dominant limb and the 2m turning performance on the non-dominant limb. Specifically the following turning performance symmetry calculation was utilised:

$$\% \text{ difference} = ((\text{Dominant} - \text{Non-dominant}) \div (\text{Non-dominant})) \times 100$$

Injury data collection and analyses

The prospective nature of the study involved all netball players being monitored for 6 months (1 competitive season) for the occurrence of lower limb injury. Prospective study designs are considered powerful for determining the risk factors of injury (Hagglund *et al.*, 2005). Injury was defined as that which interfered with performance and required professional treatment, causing the player to miss training and/or game time (McKay *et al.*, 2001). A training session was defined as any coach-directed scheduled physical activity carried out with the team, whereas a game was considered friendly or competitive (Hagglund *et al.*, 2006).

Netball players were contacted regularly (fortnightly), via email and telephone to enquire if a lower limb injury had occurred. If an injury had occurred, information about the injury type and location (Hagglund *et al.*, 2005), was recorded by the principal researcher, as communicated by the netballer. Clinicians that were not part of the research team diagnosed the injury. For reasons, such as clinician-client confidentiality, verification of the injury from the clinician was unable to be obtained by the principal researcher. It was presumed that the information that the netball players were communicating was accurate. For analyses purposes, injured player data were grouped into an injured group with all remaining participant data being grouped into the non-injured group category. Data classification allowed comparisons in symmetry index score to be made.

Statistical analyses

The assessment of data uniformity (normal distribution) and the calculation of Pearson correlation coefficients were performed utilising Statistical Package for Social Sciences (SPSS) version 18 for Windows (SPSS, Inc., USA). Specifically, a critical appraisal approach was used to determine if each netballer's data were normally distributed following the criteria recommended by Peat and Barton (2005) for each measure. If the difference between the mean and median was within 10% of the mean, then normality was assumed. However, if this initial criterion was breached, an additional 2 of 4 criteria would also have to be breached for the data to be described as exhibiting non-normal characteristics. These criteria were: (1) mean and standard deviation test (2×SD >mean); (2) Shapiro-Wilks statistics ($p<0.05$); (3) skewness and kurtosis statistics (within 1); and (4) skewness or kurtosis/standard error (within 1.96). These procedures were used recently by Bradshaw *et al.* (2007). In the event that data were non-normally distributed, it would be naturally log transformed to allow for

parametric statistical approaches to be utilised. The data collected in this study was normally distributed and thus the following procedures were utilised.

Pearson correlation coefficients were calculated to identify associations between dominant limb asymmetry of greater than 10% for unanticipated agility performance and injury occurrence. The magnitude of the associations was qualitatively interpreted utilising the following criteria: 0.0–0.1 poor; 0.1–0.3 small; 0.3–0.5 moderate; and >0.5 large (Cohen, 1990). Confidence intervals (90% CI) were processed for these correlations to show the likely range of the true correlation using the methodical MS excel spread sheet (Microsoft, Office, version 2007, California) of Hopkins (2007). Furthermore, clinical inferences were also provided on the likelihood these relationships were clinically substantial or more precisely positively true (Hopkins, 2007).

RESULTS

Lower limb injury occurred in 37.5% (n=9/24), of the netball players, which required them to miss either training and/or game time. The injuries included a variety of lower extremity ailments that can be observed in Table 1. All injuries (100%) occurred in the netballer's dominant leg (Table 1). Notably, 78% (7/9), of the injured netball players and 47% (7/15), of the non-injured netball players performed faster unanticipated turns on their dominant leg compared to the non-dominant leg. Performance times and symmetry index scores for these cases can be observed in Table 2 and Table 3 respectively. A dominant limb asymmetry of greater than 10% in performance was identified for 57% (4/7), of the injured netball players and 14% (1/7), of the non-injured netball players (Table 3). Pearson correlation coefficient analyses presented a moderate association of r=0.45 (90% Confidence interval: -0.01 to 0.75), between dominant limb asymmetry of greater than 10% and injury occurrence. There was an 89.9% likely probable chance that the association (Pearson correlation r-value), was positively true according to the analytical methods of Hopkins (2007).

***TABLE 1*: INJURED LIMB WITH CORRESPONDING INJURY TYPE OF INJURED NETBALL PLAYERS**

Injured Player	Injured limb	Injury type
1	Dominant	Ankle sprain
2	Dominant	Ankle sprain
3	Dominant	Calf strain
4	Dominant	Calf strain
5	Dominant	Patella tendonosis
6	Dominant	Patella tendonosis
7	Dominant	Achilles strain
8	Dominant	Adductor strain
9	Dominant	Shin splints

***TABLE 2*: MEAN TURNING PERFORMANCE AND SYMMETRY INDEX DIFFERENCE SCORES FOR NETBALL PLAYERS WITH DOMINANT LEG ASYMMETRY**

Variables	Injured (n=7) Mean±SD	Non-Injured (n=7) Mean±SD
Turn on dominant leg time (s)	0.78±0.15	0.85±0.09
Turn on non-dominant leg time (s)	0.90±0.13	0.92±0.11
Difference in time between limbs (%)	-13.80±10.40	-7.00±4.60

***TABLE 3*: INDIVIDUAL SYMMETRY INDEX DIFFERENCE SCORES FOR NETBALL PLAYERS WITH DOMINANT LEG ASYMMETRY**

Case	Injured Netball players	Non-Injured Netball players
1	-31.6%	-15.4%
2	-22.5%	-9.1%
3	-16.0%	-8.2%
4	-10.8%	-6.3%
5	-7.8%	-5.7%
6	-6.0%	-2.2%
7	-2.0%	-2.1%

DISCUSSION

Epidemiological studies have speculated that side-to-side (dominant to non-dominant) functional asymmetries greater than 10% can lead to injury occurrence (Burkett, 1970; Knapik *et al.*, 1991). The present study is the first to attempt to validate such an assumption utilising a prospective study design. A prospective study, which follows participants going forward in time can ascertain the aetiology of the injury and for this reason is generally viewed as a more meaningful study design compared to a retrospective study, which typically utilises injured participants and thus cannot determine the origin of the injury (Hamill & Davis, 2006).

Findings of this study indicated lower limb injury, as defined by McKay *et al.* (2001), occurred in ~38% of the netball players tested in the present study which required them to miss either training or game time. The ~22% of ankle sprains presented by the netball players were consistent with the frequency of ankle ligament sprains reported in the literature (Hume, 1993; Hopper *et al.*, 1995; Handoll *et al.*, 2001). Netball is a high-strategy sport requiring many explosive sprints, abrupt stops, change of direction and landing movements (McManus *et al.*, 2006; Bock-Jonathan *et al.*, 2007). Therefore, it is no surprise that the ankle complex would be the most commonly injured site due to the amount of stress it would encounter as a major pivot point in the kinetic link system during such movement tasks.

In the present study all injuries (100%), occurred in the netballer's dominant leg, which is consistent with the findings of others (Ekstrand & Gillquist, 1983; Chomiak *et al.*, 2000; Orchard, 2001). Limb dominance is considered a risk factor for lower extremity injury because most athletes place a greater demand on their dominant limb (Beynnon *et al.*, 2002). This can lead to an increased frequency and magnitude of moments about the knee and ankle, particularly during high-demand activities that place the ankle and knee at risk (Beynnon *et al.*, 2002). It must be acknowledged that the association between limb dominance and injury is controversial due to equivocal findings in the literature (Surve *et al.*, 1994; Seil *et al.*, 1998; Beynnon *et al.*, 2001; Matava *et al.*, 2002; Negrete *et al.*, 2007). The contrasting findings may have been the result of study designs, participant type and numbers, injury location or the methods used for data analysis. Nonetheless, the findings of this study advocate the link between limb dominance and prospective injury occurrence.

Overall 58% of the netball players assessed in this study demonstrated superior turning performance on the dominant leg relative to the non-dominant leg, which lead to the identification of dominant limb asymmetry. From an information processing theoretical perspective, the findings of the current study (the dominant limb demonstrating superior turning performance), may support the premise that participants can learn tasks more effectively with their dominant limb than with their non-dominant limb (Davidson & Wolpert, 2003), and thus increase the potential for enhanced performance. However, this unilateral demand will likely lead to functional asymmetry and differences in motor ability, especially strength and coordination (Kearns *et al.*, 2001; Haaland & Hoff, 2003). For example, Itoh *et al.* (1998), found healthy male participants had significantly more powerful (~5%; effect size=0.49), dominant leg performances when compared to the non-dominant leg during a horizontal counter-movement jump. The greater power output/performance capability in the dominant limb identified by Itoh *et al.* (1998), and the current study may be due to greater muscle mass of the dominant limb compared to non-dominant limb (Chhibber & Singh, 1970). Unfortunately girth and mass characteristics of the lower limbs were not determined in the current study to support the aforementioned premise.

It is fair to assume that in the majority of instances when comparing unilateral tasks, some magnitude of functional asymmetry will be present for an individual. The practitioner needs to be cognizant of a likely threshold at which injury risk is potentially heightened for the identified asymmetry and thus accommodate remediation intervention accordingly. As presented, earlier researchers have speculated that limb asymmetry should not exceed that of 10% (Burkett, 1970; Knapik *et al.*, 1991). However, it was uncertain if such a threshold was valid, thus the primary purpose of this study was to identify an association between dominant lower limb asymmetry of greater than 10% in unanticipated agility performance and prospective injury occurrence. It was hypothesised that players exhibiting a dominant lower limb asymmetry of greater than 10% would more likely obtain a lower extremity injury. Pearson correlation coefficient analyses presented a moderate association between dominant limb asymmetry of greater than 10% and injury occurrence, which supports this study's hypothesis. Furthermore, a number of injured netball players investigated in this study exceeded the 10% asymmetry threshold. These findings validate the assumption that an excessive over reliance on the dominant limb can lead to injury over time. Thus, the 10% limb functional asymmetry threshold appears appropriate for physical conditioners to implement in their pre-habilitative conditioning regimes with their athletes. If an

excessive

discrepancy exists, training strategies that minimise the functional difference are recommended. Additionally, research into such training interventions warrants future investigation.

It should be acknowledged that this study's findings are directly related to female netball players and their ability to perform unanticipated turning tasks. The reader is advised to be cautious when attempting to apply the findings to other forms of unilateral functional tasks and corresponding symmetry index scores. Further research is required that incorporates a prospective study design and investigates limb asymmetries in different motor tasks (vertical jumping, horizontal bounding) and the association with injury occurrence.

A number of methodological limitations were present in this study and thus the results need to be interpreted with caution. Firstly, the unanticipated sprint stimulus was simulated via computer software on a digital screen in a controlled laboratory environment. It is possible that limb functional asymmetry observations may be different with the addition of competitors and other possible environmental perturbations during a competitive field setting. Another, limitation to this study was the diagnosis of injury occurrence by clinicians that were not part of the research team. For reasons such as clinician-client confidentiality, verification of the injury from the clinician was unable to be obtained by the principal researcher. It was presumed that the information communicated by the netball players was accurate. The inclusion of a qualified clinician as part of the research team would have strengthened the validity of the reported injury occurrence data. A further limitation was the lack of monitoring training and playing loads of the netball players throughout the prospective portion of this study. This type of monitoring was not considered until after the completion of the study as initially this study was only interested in establishing whether or not dominant limb functional asymmetry would lead to injury occurrence in a given period. A final limitation to be acknowledged in this study is the sample size especially for the injured netball player cohort. It is recommended that future research incorporate a similar methodology to that utilised in this study with attention being given to rectifying the limitations outlined.

CONCLUSION

In conclusion the study provides evidence indicative of a likely probable link between dominant limb asymmetry of greater than 10% in turning performance and lower limb injury occurrence in female netball players. Based on the present findings favouring a lower limb during performance may be unfavourable to an athlete's health prospectively. Thus, the conditioning specialist is advised to assess the functional differences between an athlete's limbs to determine if an excessive (>10%) asymmetry is present, especially for tasks that require the ability to utilise both sides of the body. If an excessive discrepancy exists, training strategies that minimise the functional difference are recommended. There is still a need for further research that incorporates a prospective study design and investigates limb asymmetries in different motor tasks (vertical jumping, horizontal bounding) and the association with injury occurrence.

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Dr. Peter MAULDER: School of Sport and Exercise Science, Waikato Institute of Technology, Private Bag 3036, Hamilton, New Zealand. Tel.: +647 834 8800 (ext. 8929), E-mail: Peter.maulder@wintec.ac.nz

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ESTIMATING SUCCESS PROBABILITY OF A RUGBY GOAL KICK

AND DEVELOPING A MEASURE FOR RANKING RUGBY UNION GOAL KICKERS

Jurie NEL
Assupol Life, Pretoria, Republic of South Africa

ABSTRACT

The objective of this study was firstly to derive a formula to estimate the success probability of a particular rugby goal kick and, secondly to derive a goal kicker rating measure that could be used to rank rugby union goal kickers. Various factors that could influence the success of a particular goal kick were considered. A logistic regression analysis was performed to obtain the significant factors that were found to be the most important factors in the estimation of the success probability of a particular goal kick. The estimated success probability of the goal kick was then used to allocate a difficulty rating for the particular goal kick. The result of goal kicks attempted by the kicker along with the difficulty rating of these kicks was used to derive a measure for the ranking of rugby goal kickers. Goal kicker performances during the 2011 Rugby World Cup Tournament were used to illustrate the workings of the ranking system.

Key words: Goal kicker ranking; Rugby Union; Success probability; Difficulty rating.

INTRODUCTION

Goal kicking in rugby takes place after a try has been scored or a penalty has been awarded. The rugby ball is placed in an upright, static position and the goal kicker then attempts to kick the ball over the crossbar and between the two uprights of the goal posts (IRB, 2012). Berry and Berry (1985) used a data-analytic approach to estimate the probability that a field goal in American Football attempted from a certain distance will be successful for a particular kicker. They proposed measures by means of which to compare two kickers, such as the estimated probability of converting a 40-yard field goal for each of the two kickers.

The probability of a rugby goal kicker being successful with a particular goal kick depends on various factors. Bilder and Loughin (1997) did a study to determine the key factors affecting the success of a field goal in American Football. They found that the distance of the kick is most important, but also that field goal attempts, which could cause a change in lead, were more likely to be missed than others. Other factors that they considered and which were found to be of lesser significance in predicting whether a field goal would be successful include:

- Outside placekicks versus kicks inside a dome;
- Kicks at a kicker's home field versus kicks at the opponent's field;
- Kicks on turf versus kicks on artificial surfaces;

- Temperature at the time of the game;
- Time during the game when a kick was attempted;

- Wind speed when kick was attempted.

Table 1 includes the factors that were considered as explanatory variables to estimate the probability of a rugby goal kick being successful (some explanatory variables were transformed to binary variables for use in the analysis).

***TABLE 1*: EXPLANATORY VARIABLES CONSIDERED IN THE LOGISTIC REGRESSION ANALYSIS**

Variable	Description
Altitude	Whether the kick was attempted at below or above 1000m above sea level (variable was transformed to a binary variable)
Angle	Angle of the kick in degrees
Distance	Distance of the kick in meters
Half	Whether the kick was attempted during the 1st or 2nd half of the game (variable was transformed to a binary variable)
Type	Whether the kick was a penalty kick or a conversion kick. A conversion kick is attempted after a try has been scored (variable was transformed to a binary variable).
Pressure	Whether the kick: if successful, will result in the team closing to within one score of the opponents; if successful, will result in the team remaining within one score of the opponents; if successful, will result in the scores being level; is taken while the team's lead is still within one score of the opponent's (a maximum of seven points can be scored at a time in Rugby Union (IRB, 2012)) (variable was transformed to a binary variable)

Data regarding weather conditions, including rain and wind, was not captured. Weather conditions may influence the probability of a kick being successful, but due to a lack of objective data it could not be included in the analysis.

METHOD

Sample

Rugby goal kick data was obtained from games played during the 2011 Rugby World Cup Tournament in New Zealand (2011 RWC Tournament), the 2012 Super-15 Tournament played in South Africa, New Zealand and Australia (S15 Tournament) and the 2012, 6-Nations Tournament played in Europe (6N Tournament). Data for 1 249 goal kicks attempted in these tournaments were hand-captured using video footage and used for the purpose of the study.

Measurements

Data captured included:

- Approximate angle of kick in degrees;
- Approximate length of kick in meters;
- Date when the game was played;
- Field where the game was played;
- Final score;
- Foot used for goal kicks;
- Player (kicker);
- Score at time of kick;
- Team against;
- Team for;
- Type of goal kick – penalty or conversion;
- When the goal kick was attempted – 1st or 2nd half;
- Whether the kick was successful or unsuccessful;
- Winning team;
- Zone from which kick attempted.

Rugby field dimensions and zones analysed

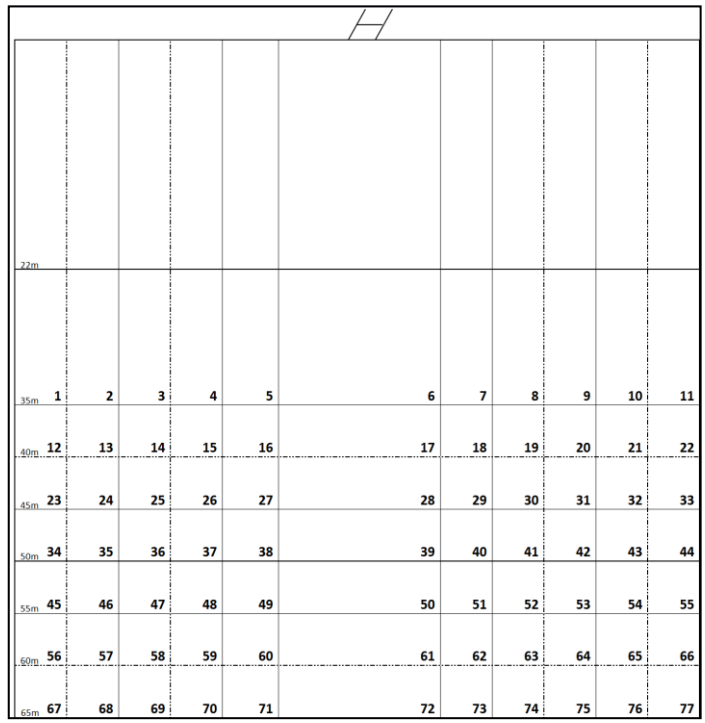

***FIGURE 1*: RUGBY FIELD DIVIDED INTO 77 ZONES**

The length of a rugby field may not exceed 100m, excluding the in-goal areas behind the goal posts, and it may not be wider than 70m (IRB, 2012). The kick data was captured in 77 zones on the rugby field (Figure 1). The zones were constructed so that the 77 zones

covered the entire rugby field and that all kicks from a particular zone were of the same approximate difficulty. The 77 zones were constructed using some of the lines already on the rugby field to assist with the data capturing. The zones were 5m long by 5m wide, except for zones 1 to 11 (these zones were closest to the goal posts and could not only be 5m in length) and the zones in front of the goal posts.

Probability of a successful goal kick

Following Hosmer and Lemeshow (2000), a logistic regression analysis that included possible explanatory variables that could explain the dependent variable (probability of a successful goal kick) was performed. Results of the logistic regression analysis are summarised in Table 2.

***TABLE 2*: RESULTS OF LOGISTIC REGRESSION ANALYSIS**

Variable	Coefficient	Standard Error	Wald Chi-Square	Pr> Chi^2
Intercept	4.663	0.339	189.106	<0.0001
Altitude	0.580	0.250	5.374	0.0200
Angle	-0.016	0.004	13.191	0.0000
Distance	-0.097	0.008	161.206	<0.0001
Half	-0.036	0.140	0.066	0.7970
Type	-0.100	0.178	0.312	0.5760
Pressure	0.128	0.164	0.609	0.4350

From Table 2, it can be seen that altitude, angle and distance were the significant explanatory variables at a 2.5% significance level.

Final model

After the initial variable screening process, the model that best estimates the probability of a successful goal kick was developed (Hosmer & Lemeshow, 2000).

where

$\hat{y}_i$

$$= \frac{1}{(1 + e^{-(\beta_0+\beta_1\times\text{altitude}_i+\beta_2\times\text{angle}_i+\beta_3\times\text{distance}_i)}}$$

$\hat{y}_i$ = probability of a kick i being successful
altitude_i = 1 if kick i attempted at >= 1000m above sea level, else 0
angle_i = angle of kick i in degrees
distance_i = distance of kick i in meters

β_0 = 4.666 β_1 = 0.572 β_2 = -0.015 β_3 = -0.098

This equation can therefore be used to calculate the probability of success of a goal kick based on the altitude above sea level at which the goal kick is attempted, the angle of the goal kick and the distance of the goal kick.

Difficulty rating of goal kicks

The success probability of a particular goal kick indicates the difficulty of the goal kick (the lower the success probability, the higher the difficulty of the kick). The success probability of a particular goal kick can be used to derive a difficulty rating for the particular goal kick.

Let:

D_i

$$= \frac{1}{y_i} \quad -$$

where

D_i= Difficulty rating of kick i

y_i = Probability of kick i being successful

Goal kicker performance rating

The performance rating of a goal kicker is an objective measure of the goal kicker's performance based on the success he had with the kicks he attempted and the difficulty of the kicks. The *success percentage* (the number of successful goal kicks made by a kicker divided by the total number of goal kicks attempted) is combined with the *difficulty rating* of the kicks attempted by the goal kicker to derive a measure for the *ranking* of rugby goal kickers.

During a particular rugby game, or over a number of rugby games, the following equation is proposed for kicker j:

$$\text{goal kicker performance rating}_j = success\_percentage_j \times \text{average difficulty rating of successful kicks}_j$$

Where:

$$\text{success\_percentage}_j = \sum^{n} \text{success}$$

$$\frac{\sum_{k=1}^{n} \text{kj}}{n}$$

goal kicker performance rating$_j$ = Performance rating for goal kicker j for that particular game or over a number of

games success$_{kj}$ = 1 if kick k attempted by kicker j was successful, else 0

average difficulty rating of successful kicks$_j$ = Average difficulty rating of kicker j's kicks for that particular game or over a number of games

n = number of kicks that goal kicker j attempted for that particular game or over a number of games

The average or expected goal kicker performance rating is 1. The *goal kicker performance rating* can be gauged as follows: >1 suggests better than average goal kicker performance; and <1 suggests poorer than average goal kicker performance.

RESULTS

The three tables to follow indicate the goal kicker performance statistics for the 2011 RWC Tournament.

***TABLE 3*: RANKING OF PLAYERS BY SUCCESS PERCENTAGE**

Kicker	Country	No. Kicks Attempted	No Successful	Success %	Success % Ranking
1	South Africa	6	6	100%	1
2	Wales	15	13	87%	2
3	Ireland	22	19	86%	3
4	France	14	12	86%	3
5	Fiji	12	10	83%	5
6	Australia	5	4	80%	6
7	South Africa	27	21	78%	7
8	Australia	28	20	71%	8.5
9	England	14	10	71%	8.5
10	Samoa	10	7	70%	10
11	Wales	19	13	68%	12
12	France	22	15	68%	12
13	Tonga	25	17	68%	12
14	New Zealand	12	8	67%	16
15	USA	3	2	67%	16
16	Canada	12	8	67%	16
17	Romania	6	4	67%	16

18	Samoa	12	8	67%	16
19	New Zealand	23	15	65%	19
20	Japan	14	9	64%	20.5
21	Italy	11	7	64%	20.5
22	New Zealand	24	15	63%	23
23	USA	8	5	63%	23
24	Scotland	8	5	63%	23
25	Scotland	13	8	62%	25
26	Georgia	17	10	59%	26
27	Russia	7	4	57%	27.5
28	Italy	7	4	57%	27.5

***TABLE 3*: RANKING OF PLAYERS BY SUCCESS PERCENTAGE (*cont.*)**

Kicker	Country	No. Kicks Attempted	No Successful	Success %	Success % Ranking
29	Wales	15	8	53%	29
30	Canada	8	4	50%	31
31	Argentina	16	8	50%	31
32	Australia	8	4	50%	31
33	England	21	10	48%	33
34	Argentina	17	8	47%	34
35	Ireland	14	6	43%	35
36	Namibia	10	4	40%	36
37	Romania	14	5	36%	37
38	Russia	6	2	33%	38
39	Italy	3	0	0%	39

***TABLE 4*: RANKING OF PLAYERS BY THE AVERAGE DIFFICULTY RATING OF GOAL KICKS**

Kicker	Country	Ave. difficulty rating of goal kicks	Ave. difficulty rating of goal kicks ranking

36	Namibia	2.11	1
24	Scotland	1.77	2.5
12	France	1.77	2.5
5	Fiji	1.71	4
26	Georgia	1.61	5
6	Australia	1.57	6
37	Romania	1.55	7
18	Samoa	1.53	8
7	South Africa	1.50	9
13	Tonga	1.49	10
3	Ireland	1.48	11
9	England	1.47	12.5
14	New Zealand	1.47	12.5
32	Australia	1.45	14.5
33	England	1.45	14.5
25	Scotland	1.41	16
11	Wales	1.38	17

TABLE 4*: RANKING OF PLAYERS BY THE AVERAGE DIFFICULTY RATING OF GOAL KICKS *(cont.)

Kicker	**Country**	**Ave. difficulty rating of goal kicks**	**Ave. difficulty rating of goal kicks ranking**

19	New Zealand	1.36	18
34	Argentina	1.35	19.5
31	Argentina	1.35	19.5
4	France	1.34	21
16	Canada	1.32	22
35	Ireland	1.31	23.5
8	Australia	1.31	23.5
10	Samoa	1.30	25
27	Russia	1.29	26
29	Wales	1.28	27
38	Russia	1.25	28
2	Wales	1.24	30
30	Canada	1.24	30
22	New Zealand	1.24	30
21	Italy	1.22	32
20	Japan	1.19	33
23	USA	1.18	34
17	Romania	1.15	35
28	Italy	1.10	36.5
1	South Africa	1.10	36.5
15	USA	1.05	38
39	Italy	-	39

***TABLE 5*: RANKING PLAYERS BY OVERALL GOAL KICKER PERFORMANCE RATINGS AND RANKINGS**

Kicker	Country	Goal Kicker Performance Rating	Goal Kicker Performance Ranking
5	Fiji	1.42	1
3	Ireland	1.28	2
6	Australia	1.26	3
12	France	1.21	4
7	South Africa	1.17	5
4	France	1.15	6

***TABLE 5*: RANKING PLAYERS BY OVERALL GOAL KICKER PERFORMANCE RATINGS AND RANKINGS (*cont.*)**

24	Scotland	1.11	7
1	South Africa	1.10	8
2	Wales	1.07	9
9	England	1.05	10
18	Samoa	1.02	11
13	Tonga	1.01	12
14	New Zealand	0.98	13
26	Georgia	0.95	14
11	Wales	0.94	15.5
8	Australia	0.94	15.5
10	Samoa	0.91	17
19	New Zealand	0.89	18
16	Canada	0.88	19
25	Scotland	0.87	20
36	Namibia	0.84	21
21	Italy	0.77	23.5
22	New Zealand	0.77	23.5
17	Romania	0.77	23.5
20	Japan	0.77	23.5
27	Russia	0.74	26.5
23	USA	0.74	26.5
32	Australia	0.73	28
15	USA	0.70	29
33	England	0.69	30
29	Wales	0.68	31
31	Argentina	0.67	32
34	Argentina	0.64	33
28	Italy	0.63	34
30	Canada	0.62	35
35	Ireland	0.56	36
37	Romania	0.55	37
38	Russia	0.42	38
39	Italy	0.00	39

DISCUSSION

The results in Table 3 indicate that only one player was successful with all his attempts at goal (Player 1: 100% success). According to Table 4, player 1 was successful with all 6 goal kicks he attempted, but this table shows that the average difficulty rating of goal kicks for Player 1was low (ranked 36.5 out of the 39 players). Player 36 had the highest average difficulty rating of goal kicks. This may be one of the reasons why he only ranked 36th by success percentage. On viewing the results of Table 5, Player 5 was the best goal kicker during the 2011 RWC Tournament based on the success percentage he achieved together with the average difficulty rating of goal kicks. Player 24 ranked 23rd by success percentage, but

much better (7th) by the overall goal kicker performance rating. This is due to the relatively high average difficulty rating of his goal kicks (ranked 2.5 out of the 39 players).

Considering players ranked in the top 10 by their goal kicker performance rating, Player 5, Player 6 and Player 7 are the only players ranked in the top 10 by success percentage, as well as the average difficulty rating of goal kicks.

CONCLUSIONS

A formula was derived to estimate the success probability of a rugby goal kick. The most important variables determining the success probability of a particular goal kick were determined as the altitude above sea level at which the goal kick was attempted, the angle of the goal kick and the distance of the goal kick.

The success probability was then used to allocate a difficulty rating for the particular goal kick. The result of goal kicks attempted by the kicker along with the difficulty rating of these kicks is used to derive a performance rating for the goal kicker.

Goal kicker performance ratings provide an objective measure that could be used by rugby analysts and enthusiasts, as well as television broadcasters to better judge the goal kicking performance of goal kickers. By ordering goal kickers' goal kick performance ratings, a goal kicker ranking measure could be established to be used during tournaments or continuously to rank goal kickers objectively.

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Mr. Jurie NEL: PO Box 8401, Centurion 0046, Republic of South Africa. Cell: +27 084 5577 007, Tel.: +27 (0)12 741 4161, E-mail: jurien@assupol.co.za

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FATIGUE ON PLANTAR PRESSURE DISTRIBUTION

Pierre E. OLIVIER
Department of Sport Science, Stellenbosch University, Stellenbosch, Republic of South Africa

ABSTRACT

Running induced lower limb muscle fatigue does not identify which loading alterations relate to fatigue of specific muscles. The purpose of the present study was to compare the effect of selectively induced fatigue of the lower limb muscles on plantar pressure distribution. Twelve male participants were assessed. A quasi-experimental pre-test post-test design was applied. The RS Scan system prior to and following dominant leg concentric isokinetic ankle invertor/evertor (InEv-F) and plantar-/dorsiflexor (PD-F) fatiguing was used. Maximum pressure (kPa) and impulse for 10 plantar regions of the dominant leg was measured. Differences between the dependant variables were evaluated with repeated-measures ANOVA with Tukey HSD tests for post hoc analysis ($p<0.05$). InEv-F and PD-F resulted in increased forefoot and decreased toe pressure and impulse. InEv-F attributed to significantly decreased heel pressure. Fatigue of tibialis anterior and posterior, achieved during both InEv-F and PD-F, resulted in loading similarities during fatigue. Independently InEv-F and PD-F contributed to increased injury risk through altered loading. To mitigate the injury risks of running associated with lower limb fatigue, targeted ankle inversion/eversion and plantar-/dorsiflexion resistance training is recommended.

Key words: Plantar pressure; Foot loading; Fatigue; Running; Biomechanics.

INTRODUCTION

The foot is the final link in the kinetic chain of the lower limb and as such, plays an important role during static and dynamic activities. Statically the foot assists, through delicate muscular activity, to maintain balance (Gurney *et al*., 2008). Of equal importance is dynamic foot function during locomotion because, as Katoh *et al*. (1983) elaborate, the foot is critical to an understanding of the mechanics of gait, as it often affects the normal motion pattern of the entire lower limb. Therefore, alterations in normal foot mechanics can adversely affect the functioning of the ankle (Harradine *et al*., 2006), knee (Ghani Zadeh Hesar *et al*., 2009), hip (Khamis & Yizhar, 2007), and possibly the back (Rothbart *et al*., 1995).

An important dynamic function of the foot is to transfer the internal forces generated by the muscles to the ground so that the body can be accelerated during push-off (Saltzman & Nawoczenski, 1995). Effective measurement of dynamic foot function can be conducted through the analysis of plantar pressure distribution patterns as this provides direct information about the quality of the interaction between different structures of the foot and the ground (Orlin & McPoil, 2000). However, many factors influence plantar pressure distribution patterns. Some of these factors include, but are not limited to, ethnicity (Gurney

et al., 2009), age (Roislien *et al*., 2009), gender (Razeghi & Batt, 2002), speed of movement (Burnfield *et al*., 2004), weight (Birtane & Tuna, 2004), physical activity (Rai *et al*., 2006), shoe wear (Razeghi & Batt, 2002; Rai *et al*., 2006; Queen *et al*., 2010) and fatigue (Bisiaux & Moretto, 2008; Nagel *et al*., 2008). Muscular fatigue brings about unattenuated and altered impact loading patterns of the foot, and this has been identified as an aetiological factor in various running injuries (Christina *et al*., 2001; Nagel *et al*., 2008). Furthermore, excessive impact forces, abnormal ankle joint motion and/or loading rate (Chuter & Janse de Jonge, 2012), all generally associated with muscular fatigue, are proposed to also play a major role in running injuries (Nigg *et al*., 1995).

Treadmill or long distance running has featured most prominently as a method to induce lower limb muscle fatigue. This method enables the investigation of the influence of lower limb muscle fatigue on the impact loading of the foot. Treadmill running close to anaerobic threshold speeds induces sufficient muscular fatigue to alter associated impact loading patterns, such that an increase in forefoot pressure is observed (Weist *et al*., 2004). Plantar pressure data collected, through participants walking over a capacitive surface following the completion of a marathon race, also showed an increase in forefoot pressure and reduced pressure under the toes (Nagel *et al*., 2008). Based on these and other studies, Willems *et al*. (2012), assert that consensus exists concerning the increased forefoot loading that is induced by fatigue. This demonstrated load transfer to the forefoot, particularly to the metatarsal heads, reflects a diminished capacity of the fatigued muscles to stabilise and control the foot (Mizrahi *et al*., 2000; Weist *et al*., 2004). The increased pressure on the metatarsal heads is associated with an increased bending load and may lead to stress fractures (Bennell *et al*., 1999; Jacob, 2001). This is because a cumulative fatiguing effect results from repeated force applications below the acute injury threshold of a structure, which over time surpasses the capacity of the specific structure and leads to the development of an overuse injury (Willems *et al*., 2012).

PURPOSE OF THE STUDY

Treadmill and marathon runs to induce fatigue do not enable the identification of which fatigued muscle group, particularly of the lower limb, is predominantly responsible for the altered impact loading pattern, as well as increased risk of injury. If the responsible muscle group could be identified, specific attention through targeted exercises could be allocated to it in an attempt to prevent injuries or facilitate secondary prevention.

The purpose of the present study was to determine and compare the effects of selectively induced fatigue of the invertor/evertor and plantar-/dorsiflexor muscle groups upon the impact loading characteristics of the foot as represented by plantar pressure distribution, impulse and the forefoot to toe loading ratio. In contrast to other studies that use treadmill and marathon runs to induce lower limb muscular fatigue, an isokinetic protocol separately targeting the invertor/evertor and plantar-/dorsiflexor muscle groups was employed in the present study to selectively and independently induce fatigue. In addition, the use of an isokinetic fatiguing protocol allowed for an accurate determination of when muscular fatigue occurred.

METHOD

Subjects

Twelve male participants (mean±SD; age, 23.58±2.68 years; body mass, 76.62±11.68kg; height, 175.07±7.76cm), who were enrolled postgraduate students, volunteered to participate in this study. The participants conformed to the inclusion criteria of this study, which included no current or previous foot injury, or current lower limb injury. The Nelson Mandela Metropolitan University Research Ethics Committee (Human) approved the study, and informed consent was obtained from all participants.

Anthropometric measurements

Subsequent to obtaining informed consent, each participant was assessed anthropometrically. Measurements of body mass and stature were conducted. The measurement of body mass was made with the participant clothed as minimally as possible (Norton *et al.*, 1996) and accurately recorded to the nearest 0.01kg as measured by an electronic scale (ScaleMaster). The measurement of stature involved the participant standing with his feet together at the heels, and with buttocks and scapulae touching the vertical board of the stadiometer (Holtain). Stature was taken with the participant wearing no footwear (socks were allowed) and as little clothing as possible, so that the body position could be clearly visible. The participant's weight was evenly distributed over both feet and the head placed in the Frankfort plane. The headboard of the stadiometer was pushed down firmly onto the vertex of the skull, depressing the hair as much as possible. The measurement, according to the procedure as described by Norton *et al.* (1996), was then taken at the end of a deep inhalation and accurately logged to the nearest 0.1cm.

Isokinetic fatiguing protocol

Prior to the measurement of plantar pressure distribution, isokinetic fatiguing protocols were performed on a Cybex Norm. Isokinetic fatigue of the invertors/evertors and plantar-
/dorsiflexors was achieved by participants performing continuous concentric contractions at $60°.sec^{-1}$. The method, as described by Yaggie and McGregor (2002), was used to determining fatigue. This entailed the performance of three consecutive maximal concentric repetitions against the isokinetic dynamometer to determine a peak torque value. After 5 minutes of rest, maximal concentric repetitions were performed against the dynamometer until fatigue occurred. The point at which invertor/evertor and plantar-/dorsiflexor torques, respectively, decreases below 50% of the applicable peak torque value (determined previously), was regarded as being representative of fatigue.

Plantar pressure measurement

Measurement of maximum pressure (in kPa) and impulse per square centimetre (in $Ns.cm^{-2}$) for 10 identified regions (T1 - hallux; T2-5 - toes 2-5; M1 - metatarsal 1; M2 - metatarsal 2; M3 - metatarsal 3; M4 - metatarsal 4; M5 - metatarsal 5; MF - mid-foot; HM - medial heel & HL - lateral heel), of the plantar surface, as well as the forefoot to toe loading ratio [(Σimpulse under M1 to M5)/(Σimpulse under T1 and T2-5)], was conducted by having the participants walk over a 2m long capacitive surface (Footscan® RSScan International, Olen, Belgium). Participants were instructed to walk across the measurement surface in

approximately 1.6s, which translated to a walking speed of approximately 1.25m.s^{-1}. To assist participants with obtaining the correct speed a digital timer, connected to photocells positioned at the edges of the capacitive surface, displayed the participant's time taken to cross the capacitive surface. Each participant completed 10 trials with each trial starting with an alternate foot. Similar measurements for each participant were made prior to and following each of the concentric isokinetic ankle InEv-F and PD-F protocols, which were performed on the dominant leg. The dominant leg was taken as the leg identified by the participant.

To negate the impact of DOMS (Delayed Onset of Muscle Soreness), a period of 5 days elapsed between the performance of the selectively induced muscular fatigue protocols of the invertor/evertor and plantar-/dorsiflexor muscles and subsequent measurement of plantar pressure distribution. Owing to practical considerations related to the fatiguing protocol, selected data analysis of plantar maximum force and impulse, as well as forefoot to toe loading ratio was conducted for the dominant leg only.

Statistical analyses

The collected data was labelled as pre-fatigue (Pre-F), invertor/evertor fatigue (InEv-F) and plantar-/dorsiflexion fatigue (PD-F). Averaging the data collected from the 10 trials performed prior to and following each of the fatiguing protocols generated a representative data set for each participant. This data was then used to perform descriptive (means and standard deviations) and inferential statistics. Significant differences between the data were evaluated with repeated-measures ANOVA with Tukey HSD tests for post hoc analysis ($p<0.05$). All statistical analyses were performed with the use of STATISTICA (v.10.0).

RESULTS

Tables 1 and 2 display descriptive (mean±SD) and inferential statistical results for maximum pressure and impulse per square centimetre data measured at the 10 plantar regions during the pre- and post-fatigued states.

Table 1, which displays maximum pressure data, demonstrates that a significant reduction in pressure was observed at T1, following both InEv-F and PD-F, when compared to the Pre-F. Following InEv-F, significantly decreased pressure was also observed at T2-5, Ml and M2 compared to pressure measured during Pre-F. It is of interest to note that following PD-F significantly more pressure was measured at Ml, M2, M3 and M4, compared to that measured following InEv-F. These pressure measurements were, however, not significantly different from those measured during Pre-F. A significant decrease in pressure was measured during InEv-F and PD-F at HM and HL compared to Pre-F. Furthermore, a significant decrease in pressure was measured at HM and HL during InEv-F, compared to similar measurements during PD-F.

***TABLE 1*: MAXIMUM PRESSURE (kPa) BEFORE AND AFTER INDUCED FATIGUE**

Variables	Pre-F	InEv-F	PD-F
T1	91.84 ± 25.59	71.33 ± 27.63*	77.54 ± 22.28*
T2-5	17.61 ± 7.71	11.50 ± 5.73*	14.43 ± 7.87

Ml	108.74 ± 49.83	84.99 ± 37.48*	105.25 ± 43.33†
M2	179.80 ± 38.14	157.13 ± 34.57*	177.54 ± 43.64†
M3	192.48 ± 33.59	178.19 ± 29.26	203.76 ± 43.33†
M4	128.62 ± 27.77	117.63 ± 26.67	135.48 ± 32.14†
M5	58.15 ± 28.28	52.76 ± 28.66	55.53 ± 25.45
MF	21.35 ± 8.99	18.17 ± 7.85	22.29 ± 8.79†
HM	188.72 ± 33.28	159.96 ± 21.23*	175.61 ± 27.54*†
HL	165.04 ± 30.71	133.37 ± 22.74*	144.86 ± 32.97*†

Pre-F - Pre-fatigue; InEv-F - Invertor/evertor fatigue; PD-F - Plantar-/dorsiflexor fatigue
T1 - hallux; T2-5 - toes 2-5; MI - metatarsal I; M2 - metatarsal 2; M3 - metatarsal 3; M4 - metatarsal 4; M5 - metatarsal 5; MF - mid-foot; HM - heel medial; HL - heel lateral
* Statistically significant difference between pre-fatigue and invertor/evertor or plantar-/dorsiflexor fatigue ($p<0.05$)

† Statistically significant difference between invertor/evertor fatigue and plantar-/dorsiflexor fatigue ($p<0.05$)

***TABLE 2*: MAXIMUM IMPULSE PER SQUARE CENTIMETRE ($Ns.cm^{-2}$) BEFORE AND AFTER INDUCED FATIGUE**

Variables	Pre-F	InEv-F	PD-F
T1	1.66 ± 0.52	1.24 ± 0.56*	1.38 ± 0.42
T2-5	0.22 ± 0.11	0.15 ± 0.09*	0.19 ± 0.14
Ml	2.61 ± 1.30	2.03 ± 1.00*	2.65 ± 1.22†
M2	4.28 ± 1.07	3.77 ± 1.04*	4.34 ± 1.15†
M3	4.85 ± 1.13	4.49 ± 1.08	5.20 ± 1.44†
M4	3.47 ± 0.98	3.17 ± 0.71	3.68 ± 1.03
M5	1.51 ± 0.83	1.41 ± 0.80	1.53 ± 0.85
MF	0.49 ± 0.18	0.42 ± 0.17	0.54 ± 0.22†
HM	3.98 ± 0.92	3.27 ± 0.75*	3.65 ± 0.89*†
HL	3.42 ± 0.91	2.72 ± 0.72*	3.04 ± 0.91*†

Pre-F - Pre-fatigue; InEv-F - Invertor/evertor fatigue; PD-F - Plantar-/dorsiflexor fatigue

T1 - hallux; T2-5 - toes 2-5; MI - metatarsal I; M2 - metatarsal 2; M3 - metatarsal 3; M4 - metatarsal 4; M5 - metatarsal 5; MF - mid-foot; HM - heel medial; HL - heel lateral
* Statistically significant difference between pre-fatigue and invertor/evertor or plantar-/dorsiflexor fatigue ($p<0.05$)

† Statistically significant difference between invertor/evertor fatigue and plantar-/dorsiflexor fatigue ($p<0.05$)

Table 2 displays impulse per square centimetre data and the pattern observed significant differences between the pre- and post-fatigued states are very similar to those observed in the maximum pressure data displayed in Table 1. This is due to the impulse per square centimetre

variable (measured in $Ns.cm^{-2}$), being a representation of the maximum pressure (measured in kPa, where $1kPa=10N.cm^{-2}$), with the additional consideration of how long the particular plantar region was in contact with the capacitive surface. As speed of movement over the capacitive surface was controlled the above-mentioned result was expected.

In Table 3 the forefoot to toe loading ratio, calculated with the impulse per square

centimetre data is presented. It displays the forefoot to toe loading ratio as calculated for the pre- and post-fatigued states. A significantly larger ratio was calculated subsequent to InEv-F compared to Pre-F.

***TABLE 3*: FOREFOOT TO TOE LOADING RATIO BEFORE AND AFTER INDUCED FATIGUE**

Variable	Pre-F	InEv-F	PD-F
Ratio	1.66 ± 0.52	1.24 ± 0.56*	1.38 ± 0.42*

Pre-F - Pre-fatigue; InEv-F - Invertor/evertor fatigue; PD-F - Plantar-/dorsiflexor fatigue

* Statistically significant difference between pre-fatigue and invertor/evertor or plantar-/dorsiflexor fatigue ($p<0.05$)

DISCUSSION

The repeated stretch-shortening cycles of a muscle affects its force production by reducing neural input and lowering the efficiency of the contractile mechanism (Nicol *et al*., 1991). The resultant muscular fatigue of the lower limb causes diminished stability and control of the ankle (Mizhari *et al.,* 2000; Weist *et al.,* 2004). Bisiaux and Moretto (2008), suggest that these fatigue induced movement pattern changes and their consequential mechanical repercussions, are responsible for plantar pressure differences and increased injury risk.

Similar to the results of Bisiaux and Moretto (2008) and Nagel *et al.* (2008), a significantly decreased maximum pressure under the hallux (T1) and heel (HM & HL), following induced fatigue (InEv-F and PD-F), was observed. Associated with these pressure decreases there was a notable, but not significant, increase in pressure under the forefoot (M3 & M4), following PD-F compared to Pre-F. Similarly for the measures of impulse, non-significant decreases under the toes (T1 & T2-5), and increases under forefoot (M1–M5), were noted as a result of PD-F compared to Pre-F. Comparable to the results of Nagel *et al*. (2008) and Willems *et al*. (2012), a significant decrease in pressure was observed following PD-F, compared to Pre-F, under the lesser toes (T2-5). This was, however, not observed by Bisiaux and Moretto (2008).

Although some reported results of PD-F, compared to Pre-F, were non-significant, the general trend was in accordance with observations made by Weist *et al.* (2004), Bisiaux and Moretto (2008), Nagel *et al.* (2008) and Willems *et al*. (2012), that a transfer of load from the toes to the forefoot occurs with running induced fatigue. This can be ascribed to the obvious similarities between the ankle motion used to induce PD-F and running. The lack of definitive significant differences, as compared to studies mentioned previously, might be attributed to the non-involvement of the toes during isokinetic fatiguing. Willems *et al*. (2012) noted that

decreases in toe loading especially are seen in studies in which fatigue was induced by aerobic gait tasks. Nagel *et al*. (2008) speculated that fatigue resulted in a reduced involvement of the toes during push-off, which was associated with increased dorsiflexion in the metatarsophalangeal joints and lead to increased maximum pressure and impulse

under the metatarsal heads. Thijs *et al*. (2008) found that increased peak force observed under metatarsal two (M2) and three (M3) increased the risk of novice recreational runners experiencing the patellofemoral pain syndrome (PFPS).

With regard to increased forefoot loading, the effect of PD-F appeared to be more pronounced than that of InEv-F. Although significantly reduced pressure and impulse, as a result of InEv-F, were observed under the hallux (T1) and lesser toes (T2-5), a significant transfer of load to the forefoot did not follow. In fact a reduction in pressure and impulse, which was significant under Ml and M2, occurred following InEv-F compared to Pre-F. Christina *et al.* (2001) surmised that in particular dorsiflexor muscle fatigue is associated with increased impact loading, thus explaining the more pronounced results associated with PD-F.

Similar pressure and impulse distribution patterns in response to InEv-F and PD-F were not observed. However, the general trend regarding plantar pressure distribution was similar. The forefoot to toe loading ratio prominently displays this. Ratios calculated, following both InEv-F and PD-F, were significantly larger than the Pre-F ratio. This indicated a significant shift of loading toward the forefoot and subsequent increase in injury risk as a result of fatigue.

Each isokinetic fatiguing protocol focussed on specific agonist/antagonist muscle pairs responsible for the control of ankle motion. Fatiguing of the respective muscle pairs brought about specific movement pattern changes and their consequential mechanical repercussions. Hence, different plantar pressure distribution patterns were observed in response to InEv-F and PD-F. Similarities with respect to muscle recruitment exist between the movements performed to achieve InEv-F and PD-F. The tibialis anterior and posterior muscles, which are the primary dorsiflexor and invertor of the foot respectively, are both recruited during both isokinetic-fatiguing protocols. Fatigue of these muscles and the resulting decreased amount of dorsiflexion (Christina *et al.*, 2001), attributed to the significantly decreased heel (HM & HL) pressure and impulse observed between the fatigued states and Pre-F. Particularly fatigue of the tibialis posterior, responsible for controlling rear foot eversion (Pohl *et al*., 2010), may be responsible for the observed significant reduction in pressure and impulse under the heel.

Willems *et al*. (2012) state that fatigue of tibialis posterior may lead to imbalances about the ankle and foot, thus having significant repercussions for plantar pressure. Moreover, invertor/evertor fatigue has been found to have a significant effect on ankle joint motion and consequently loading rate (Christina *et al.*, 2001; Bisiaux & Moretto, 2008). Current results demonstrate that significantly less plantar pressure and impulse was measured under the heel (HM & HL), following InEv-F compared to Pre-F and even PD-F. Bisiaux and Moretto (2008) speculated that the decreased pressure under the heel specifically related to InEv-F, which resulted in impaired inversion-eversion foot control, shock-wave attenuation at heel strike and decreased muscular power during the loading phase. Significantly decreased pressure and impulse under the heel (HM & HL) was also observed during PD-F compared to Pre-F. Thus, both InEv-F and PD-F are associated with a decreased ability of the

musculoskeletal system to attenuate shock waves at heel strike, and thus it increases the risk

of injury (Voloshin *et al*., 1998; Mizrahi *et al*., 2000).

The use of selectively induced fatigue of the lower limb muscles to assess dynamic foot function alterations indicates that slight differences, dependant on which muscle pair was targeted, did exist. Results associated with PD-F were more pronounced, but did not always prove to be significantly different to Pre-F. Conversely, a significant shift of loading from the toes toward the forefoot did occur in response to InEv-F and PD-F, compared to Pre-F. This highlights the increased risk of injury, particularly metatarsal stress fractures, associated with lower limb muscle fatigue. In addition, significantly decreased pressure and impulse under the heel, particularly during InEv-F, highlighted the deleterious effects of fatigue on the ability of the musculoskeletal system to attenuate shock waves at impact and protect against injury. These observations, however, do not allow for a definitive identification of which fatigued muscle pair contributes more to injury risk. It thus seems prudent to advocate both targeted ankle inversion/eversion and plantar-/dorsiflexion resistance training, in addition to running, to mitigate injury risk. Following injury, the immediate return to normal running activity might not be indicated. Rather strengthening of the invertor/evertor and plantar-
/dorsiflexor muscle to control rear and forefoot motion should be advocated, in conjunction with a gradual reintroduction to running activity.

It is acknowledged that walking is a less taxing activity than running. Highlighted plantar pressure and impulse differences between Pre-F, InEv-F and PD-F are believed to be indicative of the general effects of fatigue. The isokinetic fatiguing protocols employed did not achieve fatigue of the foot muscles, as is the case with other comparative research discussed above, which used running as a fatiguing activity. Hence the effect that fatigue of these muscles would have had on foot loading is not reflected in the present data. The use of the isokinetic fatiguing protocol was integral to achieving the purpose of this research. Lastly, the small sample recruited for this study restricts the generalisability of the results. This was due to the time consuming nature of the procedure and measurements made. In spite of this, the current study contributes to our understanding of the altered foot loading characteristics as a result of fatigue of different lower limb muscle pairs.

CONCLUSION

The risk of injury associated with lower limb muscular fatigue is well established. The contribution that specific fatigued muscle pairs make to injury risk is more difficult to determine. Despite specific foot loading alterations being associated with isokinetic fatigue of specific muscle pairs, both InEv-F and PD-F fatigue independently contribute to increased injury risk. To mitigate the injury risks of running associated with lower limb fatigue, targeted ankle inversion/eversion and plantar-/dorsiflexion resistance training should be done to improve the control of fore and rear foot motion.

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Dr. Pierre E OLIVIER: Department of Sport Science, Private Bag X1, Matieland 7602, Stellenbosch University, Stellenbosch, Republic of South Africa. Tel.: +27 (0)21 808 4718, Cell: +27 083 507 1275 Fax.: +27 (0) 21 808 4817, E-mail: polivier@sun.ac.za

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BAREFOOT RUNNING CAUSES ACUTE CHANGES IN LOWER LIMB KINEMATICS IN HABITUALLY SHOD MALE RUNNERS

*Kurt H. SCHÜTTE, *Kyle C. MILES, *Rachel E. VENTER & **Sjan-Mari VAN NIEKERK

**Department of Sport Science, Faculty of Education, Stellenbosch University, Stellenbosch, Republic of South Africa*

***Department of Physiotherapy, Faculty of Health Sciences, Stellenbosch University, Stellenbosch, Republic. of South Africa*

ABSTRACT

The purpose of this study was to compare differences in knee and ankle kinematic and spatio-temporal variables at foot strike between barefoot and shod running. Twelve male runners (age 21.6±1.26 years) performed six running trials in each running condition on a 12m indoor runway at a self-selected pace. Lower limb kinematics and spatio-temporal variables were recorded with a six-camera T10 Vicon motion capture system (200Hz). In the barefoot condition runners landed with significantly greater knee flexion ($p<0.01$; ES=2.61) and less ankle dorsi-flexion ($p<0.05$; ES=1.12) compared to in the shod condition. No significant differences were found between knee varus/adduction (ES=0.78) or ankle inversion/adduction (ES=0.85) between the barefoot and shod conditions. The barefoot condition had significantly shorter contact time ($p<0.01$; ES=1.99) and step time ($p<0.05$; ES=1.13), while significantly higher step frequency ($p<0.05$; ES=1.25) compared to in the shod condition. Results indicated that immediate adaptations occurred when transitioning from shod running to barefoot running.

Key words: Barefoot running; Kinematics.

INTRODUCTION

Running has become a popular training modality and is currently considered to be one of the most important recreational activities, which not only improves overall fitness, but also provides numerous other health benefits (De Wit *et al*., 2000; Squadrone & Gallozzi, 2009). This increase in popularity has led to a greater number of runners suffering from overuse injuries as a result of impact forces at foot strike, with the ankle and knee joints as the most affected locations (Taunton *et al*., 2002; Braunstein *et al*., 2010; Sakurai & Maruyama, 2010). Both footwear and running surface have been shown to influence the foot/shoe-ground interface, of which footwear has received most attention (Hardin *et al*., 2004; Smith *et al*., 2010). Historically, runners were either barefoot or wore minimal footwear, with the modern running shoe only being invented in the 1970's (Lieberman *et al*., 2010).

According to Griffin *et al.* (2007), the running shoe is the most important piece of equipment for a runner. Running shoes are thought to provide benefits in human locomotion, such as protection, rear foot control, cushioning, attenuation of impact forces and heel stabilisation

during activity (McNair & Marshall, 1994; McPoil, 2000; Divert *et al*., 2008; Lieberman *et al*., 2010). However, research has failed to confirm the frequently claimed ability of running shoes to protect runners from injury, and even with the use of orthotics and increased cushioning, the incidence of running injuries remains high (Hart & Smith, 2008; Bacon *et al*., 2010). It has been suggested that running shoes may be a key factor leading to running injury (Hreljac, 2004; Bacon *et al*., 2010). Possible causes of injury may include abrupt collision forces (Hart & Smith 2008; Lieberman *et al*., 2010), limited proprioception (Robbins & Gouw, 1991) and over-pronation of the foot at heel strike (Clarke *et al*., 1984; Stacoff *et al.*, 1988). Barefoot running is viewed as the foundation for normal running (Clarke *et al*., 1984) and some authors suggest that habitual barefoot running could prevent impact related injuries (Stacoff *et al*., 2000; Lieberman *et al*., 2010).

Some coaches have made use of barefoot training as it is thought to provide a means for the foot to more naturally interact with the ground, improve musculoskeletal strength, train both intrinsic and extrinsic foot muscles and assist in force attenuation (Robbins & Hanna, 1987; Brüggermann *et al*., 2005; Kersting & Brüggermann, 2006; Smith *et al*., 2010; Weimar*et al*., 2010). According to Hart and Smith (2008), barefoot running increases perception of surface variations. This enables a greater variation of tendons, ligaments and motor units to be recruited with every foot strike, leading to more specific responses to the running surface (Hart & Smith, 2008). Several authors have stated that running barefoot can be viewed as a condition where prominent changes in running style, such as shorter step lengths, flatter foot placements and greater knee flexion contact angles could be expected (De Wit *et al.*, 2000; Divert *et al.*, 2005; Squadrone & Gallozzi, 2009).

Alterations in lower limb and spatio-temporal kinematics are speculated to influence the kinetics of runners and possibly reduce the risk of overuse running injuries. According to De Wit *et al*. (2000), the horizontal distance moved during the stance phase, is less while running barefoot compared to shod. Decreasing stride length while running has been marked as a potential mechanism to reduce bone strain and tibial stress fractures in runners (Edwards *et al.*, 2009). Along with touchdown velocity and the material properties of the landing surface (heel-pad, shoe, ground), impact forces are largely determined by initial footstrike angles of the knee and ankle (Gerritsen *et al*., 1995). Derrick (2004) suggested that this greater knee flexion observed at footstrike, could be an effort to decrease excessive impact forces and the potential for injury. Landing with more ankle plantar-flexion and knee flexion has been shown to reduce vertical impact peaks and loading rates in habitually barefoot runners (Squadrone & Gallozzi, 2009; Lieberman *et al*., 2010). Subsequently, higher vertical loading rates have been associated with overuse injuries, such as tibial stress fractures (Grimston *et al*., 1993; Ferber *et al*., 2002; Milner *et al*., 2007), and plantar fasciitis (Pohl *et al*., 2009), in runners.

While those accustomed to barefoot running appear to have several benefits with regard to diminished impact peaks and delayed vertical loading rates (Squadrone & Gallozzi, 2009; Lieberman *et al*., 2010), there are still many unanswered questions as to whether these benefits are easily transferable to habitually shod runners. Specifically, it is not known if all habitually shod runners will immediately and naturally learn the correct barefoot running kinematics. Robbins and Gouw (1991), stated that when habitually shod subjects run barefoot, they might experience discomfort under the plantar surface of the foot and thus

generate sufficient shock-moderating behaviour equal or greater than while running shod due to enhanced sensory protection. Similarly, Kurz and Stergiou (2005) speculated that altered coordinative strategies while running barefoot may be linked to the high perceived impact through the mechanoreceptors of the foot. These perceptions may lead to a flatter foot position to reduce the local pressure under the heel, as ground contact is covered by larger surface areas (De Wit *et al*., 2000). However, the majority of runners have accommodated to heel striking in modern day footwear (Hasegawa *et al*., 2007). Additionally, Lieberman *et al*. (2010) found that 83% of habitually shod runners will maintain a heel strike landing when running barefoot under acute conditions. The same paper by Lieberman *et al*. (2010) also mentioned that heel striking while barefoot, resulted in impact force magnitude and loading rates that are significantly higher compared to the shod condition. This suggests that some newly transitioned runners are not able to anticipate higher impact under the heel, while running barefoot and thus not able to make the necessary kinematic adjustments to decrease impact loads. These greater magnitudes and rates of impact forces could be detrimental and could place runners at risk for overuse injuries (Grimston *et al.,* 1993; Ferber *et al.,* 2002; Milner *et al.,* 2007; Pohl *et al.,* 2009).

PURPOSE OF THE STUDY

With the above considerations in mind, more research is needed to shed light on whether habitually shod runners maintain the typical shod running kinematics while under acute barefoot running conditions. Thus, the primary aim of the study was to compare the acute kinematic differences between barefoot and shod running conditions in habitually shod runners, with a focus on how alterations in the mechanical characteristics of foot/shoe-ground interface affect both the sagittal plane and frontal plane kinematics and spatio-temporal variables of the lower extremities. Based on the evidence shown by Lieberman *et al*. (2010), it was hypothesised that most runners would not adapt their lower limb kinematics due to acute barefoot running on hard surfaces.

METHODS

Participants

Twelve healthy, male recreational runners (age 21.6±1.3 years; height 1.8±0.05m; body mass 77.2±10.2kg; BMI 23.8±2.6kg/m^2) participated in the study. All participants were free from musculoskeletal injuries, running related injuries or any other conditions that would affect running gait within the previous 6 months prior to testing. Additionally, participants were excluded from the study if they had any history of foot orthotics. All participants were habitually shod runners, played sport at club level and ran between 20 and 40km per week. A few of the participants had some experience in barefoot sport (beach touch rugby), however, none of these sporting activities occurred within 3 months prior to testing. All runners received written and verbal information on the study and completed an informed consent document before participation.

Data capturing procedures

All testing and measurements were conducted in the Motion Analysis and Physiotherapy Clinic at the medical campus of the university. Kinematic data of the lower extremities were

captured using a six-camera T-10 Vicon three-dimensional motion capture system (Oxford Metrics Ltd., Oxford, UK) with Nexus 1.4 116 software, at 200Hz.

Anthropometric measurements were obtained according to standard procedures by the same laboratory technician (Certified level one anthropometrist, ISAK). Anthropometric measurements of the lower body with the participants in the standing position included leg length (defined as full leg length, measured between the ASIS marker and the medial malleolus, via the knee joint), knee width (defined as the medio-lateral width of the knee across the line of the knee axis), and ankle width (defined as the medio-lateral distance across the malleoli). A total of 35 reflective markers (14mm in diameter), were placed on the body according to the standard plug-in gait model. Specifically, 16 of the markers were used to record data of the lower body, which defined the 3D kinematics of the pelvis, and the left and right thighs, shanks and feet. Markers of the lower body were placed on the sacral (on the skin mid-way between the posterior superior iliac spines (PSIS) and positioned to lie in the plane formed by the ASIS and PSIS points); and left and right ASIS (left anterior superior iliac spine), PSIS (left posterior superior iliac spine immediately below the sacro-iliac joints, at the point where the spine joins the pelvis), thigh (over the lower lateral 1/3 surface), knee (on flexion-extension axis), tibia (over lower 1/3 surface), ankle (on the lateral malleolus along an imaginary line that passes through the trans-malleolar axis), heel (on the calcaneous at the same height above the plantar surface of the foot as the toe marker), and toe (over the second metatarsal head, on mid-foot side of the equinus break between fore-foot).

The different running conditions were performed barefoot and in the participants' own running shoes for the most typical performance (Queen *et al*., 2006; Morley *et al*., 2010). Running conditions were selected in a randomised order for each subject. Rest periods between running conditions were between 2 to 3 minutes. Over-ground running on a 12m indoor runway was selected. The measurement volume was specifically 6m long, 3m wide and 2m high. Although this might be a large volume, marker visibility during the recorded 2 steps was unaffected. Participants performed 3 practice runs for familiarisation. Each participant was instructed to run at a self-selected pace, which has been shown to improve consistency and enhance repeatability in kinematic variables (Masani *et al*., 2002; Queen *et al*., 2006). In addition, the runners were encouraged to maintain a steady speed for the running conditions. Five trials of each running condition were recorded and used for analysis. For each running trial the sum of 2 consecutive steps (one complete gait cycle), which fell within the area of the visual field was used for data analysis. Thus, 5 complete gait cycles for each participant were analysed per running condition (10 gait cycles per subject).

Means for both left and right steps were used in the analysis (Titianova *et al*., 2004). Participants were instructed to circle around and run continuously with each trial of a specific condition, without stops. After all the trials were captured, each trial was reconstructed and labelled. Possible gaps in the data were filled using either the spline- or pattern-fill options: if the gaps were smaller than 4 frames the spline-fill was used, if the gap was bigger than 4 frames pattern-fill was used. Once this was completed, the Dynamic Plug-in gait pipeline was run. Kinematic data were processed through Vicon Work station's Woltring filter (MSE=20mm). Mean values for each variable were then calculated, followed by calculation of group mean values. With the absence of kinetic data, foot strike

was determined as: horizontal velocity below tolerance (30mm/sec) + vertical downward velocity below

tolerance (30mm/sec), depending on which marker (heel or toe) contacted the ground first. Lower limb kinematic variables of interest included: spatio-temporal variables, step length (m), step frequency (steps.min^{-1}), and contact time(s); sagittal plane lower limb kinematics (knee flexion (°) and ankle dorsi-/plantar-flexion (°) at foot strike; and frontal plane lower limb kinematics (knee varus/adduction) (°) and ankle inversion/adduction (°) at foot strike.

Statistica Version 10 (StatSoft, Inc., Tulsa, OK, 2010), was used for data analysis. Independent t-tests were used for all kinematic and spatio-temporal variables. The level of significance was set at $p < 0.05$. Effect sizes (ES) were calculated between conditions (Cohen, 1990). Data are presented as group means and standard deviations.

RESULTS

The mean self-selected running speed of the subjects at foot strike was 3.63 ± 0.08m.s^{-1}. No significant differences were found in running speed between the different conditions ($p=0.75$; ES=0.33 for barefoot vs. shod). This finding could exclude running speed as a confounding variable (Dugan & Bhat, 2005).

***TABLE 1*: MEANS±S FOR SPATIO-TEMPORAL VARIABLES AND KNEE AND ANKLE JOINT KINEMATICS AT FOOTSTRIKE (DEGREES) BETWEEN BAREFOOT AND NORMAL SHOD RUNNING**

Variable	Barefoot	Shod	p-Value	ES
Step time (s)	0.353 ± 0.02**	0.371 ± 0.02	0.01	1.13##
Contact time (s)	0.210 ± 0.02**	0.246 ± 0.02	0.0001	1.99###
Step length (m)	1.28 ± 0.09	1.36 ± 0.14	0.10	0.65
Step frequency (steps.min^{-1})	170.42 ± 8.83**	161.00 ± 6.09	0.008	1.25##
Self-selected running Speed (m/s^{-1})	3.64 ± 0.26	3.53 ± 0.42	0.45	0.33
Ankle dorsi-flexion at footstrike (°)	1.64 ± 4.54*	7.87 ± 6.81	0.02	1.12##
Knee flexion at footstrike (°)	18.79 ± 3.02**	11.05 ± 3.18	0.0000	2.61###
Knee varus/adduction at footstrike (°)	6.76 ± 2.62	2.78 ± 1.04	0.08	0.78#
Ankle inversion/ adduction at footstrike (°)	2.04 ± 2.74	-0.16 ± 2.62	0.06	0.85#

* Statistically significant difference for shod, $p<0.05$; ** Statistically significant difference from shod, $p<0.01$; ### Huge effect size; ## Very large effect size; # Large effect; (-) Value represents ankle

eversion/abduction ES= Effect Size

Spatio-temporal variables

As can be seen in Table 1, contact time(s) was significantly shorter in the barefoot condition ($p=0.0001$; ES=1.99) compared to the shod condition. Step time(s) was significantly lower in the barefoot condition compared to the shod condition ($p=0.01$; ES=1.13). Step length (m) was not significantly different between the barefoot and shod conditions ($p=0.1$; ES=0.65).

Sagittal and frontal plane kinematic variables

Knee flexion was significantly higher in the barefoot condition compared to shod running ($p=0.000004$; ES=2.61), while ankle dorsi-flexion was significantly higher with running shoes compared to barefoot ($p=0.02$; ES=1.12) (Table 1). Although no significant differences were found in knee varus/adduction ($p=0.08$) or ankle inversion/adduction ($p=0.06$) between shod and barefoot running, a very large practical significant difference was found between the two conditions (knee varus/adduction ES=0.78; ankle inversion/adduction ES=0.85).

DISCUSSION

Differences in spatio-temporal and kinematic and variables were studied to gain a better understanding of changes in the lower limbs at the foot/shoe-ground interface between shod and barefoot running. The fact that significant differences were found between the running conditions in the sagittal plane supports the hypothesis that acute changes would be observed in lower limb kinematics in habitually shod runners not accustomed to barefoot running.

Barefoot running displayed significantly higher step frequencies (9.42 more steps/min), with a trend of shorter step lengths compared to the shod condition. Higher step frequencies during barefoot running have been previously reported in habitually shod (De Wit *et al.*, 2000; Divert *et al.*, 2008; Smith *et al.*, 2010) and habitually barefoot (Squadrone & Gallozzi, 2009) runners. However, reputable barefoot coaches usually recommend a minimum step frequency of 180 steps/min (Sandler & Lee, 2010; Wallack & Saxton, 2011). To achieve this, runners in the present study would have needed to increase their step frequency from shod to barefoot running by approximately 12%, of which only 6% was achieved. Reducing step lengths by 10% was predicted to reduce the probability of attaining tibial stress fractures by 3-6%, despite the corresponding increase in number of load cycles (Edwards *et al.*, 2009). Such large increases in step frequency did not occur naturally in the current participants in the barefoot condition. This suggests that habitually shod runners may require an adaptation or learning period when transitioning to barefoot running in order to completely reduce their step lengths into an acceptable impact-moderating range. Alternatively, coaches may provide verbal instruction to prevent over striding in newly transitioned barefoot runners. Studies which compare natural versus instructed changes in kinematics over a period of several weeks would help clarify whether coaching of "correct barefoot technique" is advisable for runners wishing to add barefoot running in their training regimen.

Time spent contacting with the ground was considerably reduced with the barefoot condition, which is in agreement with previous studies (De Wit & De Clercq, 2000; Squadrone & Gallozzi, 2009; Braunstein *et al.*, 2010). Derrick *et al*. (2004) theorised that the changes in spatio-temporal kinematics to barefoot running are mainly due to changes in touchdown geometry and the consequent joint movements, which occur at foot strike. Certainly,

immediate changes at the ankle angle at foot strike in the barefoot condition were observed, with an average of 6.23° more ankle plantar-flexion compared to the shod condition. On visual inspection, most of the runners acutely adapted to run with a midfoot striking pattern while unshod, with the ball of the foot and the heel landing almost simultaneously (Lieberman *et al*., 2010). Ankle plantar-flexion has been found to increase up to 12° at foot strike when running barefoot on hard surfaces compared to running in either low or high cost shoes (Bishop *et al.*, 2006).

The significantly greater ankle plantar-flexion observed during the barefoot condition in this study may have been a function of the lack of shoe heel/midsole height in the absence of a shoe, or as a function of surface hardness. Lieberman *et al*. (2010) stated that the typical rear foot strike pattern, with the ankle landing in the dorsi-flexed position, is a function of the additional heel height of the modern cushioned shoe. Similarly, Robbins and Waked (1997) speculated that shoes with thinner midsoles allow runners to sense the severity of impacts and thus adjust kinematics, while running shoes with a thicker midsole would mask the magnitude or severity of impact shock. While not controlled for, all the participants of this study wore modern running shoes with significant amount of cushioning of at least 20mm in heel height. The authors of the current study acknowledge that heel height may have affected the ankle touchdown kinematics. However, Hamill *et al*. (2011a) showed evidence, which refutes this hypothesis. These authors found that running shoes varying from 2mm to 20mm in heel height did not influence ankle dorsi-flexion angles (11.14±4.46˚) at initial contact or diminish impact force characteristics in a similar sample of participants under similar surface conditions to this study. Conversely, when their participants ran barefoot, their ankles landed in a plantar-flexed position (-7.13±3.00˚). Their study concluded that impact characteristics during running are dependent on the barefoot versus shod condition, and not dependant on the thickness of midsole cushioning. Another study from the same laboratory (Hamill *et al*. 2011b), found that while running barefoot, the majority of habitually shod runners would alter their ankle from a dorsi-flexed (7.55±6.39˚) to a plantar-flexed (-6.97±2.13˚) position as the surface changed from soft (mat) to hard (no mat). These results were believed to occur because their participants either unconsciously anticipated or actually physically experienced pain under the barefoot heel on the hard (no mat) surface and thus attempted to reduce it using altered kinematics. Indeed, some participants in the current study did mention that they experienced discomfort under their heel during the barefoot running condition. The use of a subjective questionnaire regarding individual perceived pain or discomfort under the heel could have been of benefit to this study and is advised for future research on this topic.

It should be noted that despite the significantly more plantar-flexed ankle, the variance (s=4.54°), around the mean between barefoot runners was large. This suggests that there were still some runners who maintained similar dorsi-flexion angles (heel strike pattern) to the shod condition, thus partially confirming hypothesis of this study. This finding was

evident in a previous study, yet the frequency of heel striking was significantly higher (83%) (Lieberman *et al*., 2010). It is possible that some habitually shod runners may adapt to running in heeled and cushioned shoes (Reenalda *et al.*, 2011), and may be less efficient in adapting their running style to the barefoot condition (Squadrone & Gallozzi, 2009). The results of the current study show that not all habitually shod runners will make natural anticipatory adjustments in foot strike pattern when running barefoot on hard surfaces. These specific runners may be labelled "non-adaptors" to acute barefoot running and may require

the aid of specialised verbal instructions on correct barefoot landing technique. Several proponents of barefoot running state that barefoot running is a learned skill and advocate correct barefoot technique such as "listen to your body", or "avoid landing on your heel" (Sandler & Lee, 2010; Wallack & Saxton, 2011). In a recent survey by Rothschild (2011), 184 (23.4%) out of 785 runners listed "lack of adequate instruction" as one of their highest perceived barriers when attempting transitioning to barefoot running. Yet, a vast number (671; 85.5%) stated that they would be more likely to continue with or attempt barefoot or minimalist shod running if provided with adequate instruction from a professional. Future studies should investigate the effect of verbal instructions related to "correct" barefoot landing technique on both acute and prolonged changes in foot strike kinematics. Results from such studies would help clarify whether or not such verbal instructions are beneficial from an "impact force" or kinetic standpoint.

In the current study, a significantly greater degree of knee flexion at foot strike (7.74°) was found to occur while running barefoot compared to shod, supporting previous literature (Van Woensel & Cavanagh, 1992; De Wit *et al.*, 2000; Lieberman *et al.*, 2010; Hamill *et al*., 2011a). Bishop *et al.* (2006) stated that adopting such landing strategies at the knee might be beneficial to the runner. If all other variables are kept constant, simulation models predict that this increase in knee flexion angle would decrease impact ground reaction force peaks by 526.32N (68N for every 1° increase in knee flexion). This greater knee flexion may have also helped to compensate for a more plantar-flexed ankle position at foot strike (De Wit *et al.*, 2000; Williams III *et al.*, 2000).

Although the differences between barefoot and shod conditions with respect to the frontal plane at both the knee and ankle were not significant, the very large effect size for knee varus/adduction and for ankle inversion/adduction suggests a meaningful difference. These non-significant results may have been due to large inter-individual variation found in the foot-ankle anatomy (De Wit *et al*., 2000). At the ankle joint, shod runners were already landing in an everted position at the time of foot strike. In contrast, in the barefoot condition, runners were landing in a more inverted position at foot strike, supporting previous research (Van Woensel & Cavanagh, 1992; De Wit *et al.*, 2000; Morley *et al*., 2010). Landing with an inverted foot position has important implications. A recent preliminary study showed that a relative increase (120-667%) in ankle inversion at foot strike in the barefoot condition translated to an increase in impulse (9-92%) of the ankle invertor moment compared to that of the shod condition (Samarawickrame *et al*., 2011). Samarawickrame *et al*. (2011:2) emphasised that this increase in invertor moment may cause new demands on the foot and ankle musculature and tendinous structures, and additionally stated that: "these new demands may lead to beneficial effects such as strengthening of muscles and/or detrimental effects through repetitive overloading of the

muscles, tendons and bones". Thus, care should be taken to ensure a gradual transition in running technique when habitually shod runners attempt barefoot running for the first time.

While the use of individual footwear was used to promote a more natural running gait pattern, the authors acknowledge that the individual shoe heel height and –weight, midsole stiffness and age of the running shoe were unaccounted for. These footwear characteristics may have affected the overall running kinematics of the participants in the shod condition. Future research on barefoot running should implement a transition period over several weeks to

determine if barefoot running would lead to more prominent and permanent changes in running kinematics. Moreover, no studies to date have looked at the effect of various verbal instructions suggested by barefoot coaches, on shod runners who are not able to adapt naturally to "correct" barefoot running kinematics.

CONCLUSION

The current study has provided preliminary evidence to suggest that changes in the foot/shoe- ground interface led to acute changes in selected lower limb kinematic and spatio-temporal variables at footstrike. When running in the barefoot condition, participants generally landed with greater knee flexion, possibly causing more ankle plantar-flexion with a midfoot strike placement. Participants had decreased contact times, as well as an increased step frequency when running in the barefoot condition compared to shod running. However, some runners did not adapt their kinematics, which suggests that a level of skill may be involved when transitioning to the barefoot condition. Running coaches are thus advised to educate those wanting to transition to barefoot running that correct barefoot running kinematics may not come naturally and may require a skill component. Certain verbal cues could be of value for these "non-adaptors".

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Dr. Rachel E. VENTER: Department of Sport Science, Private Bag X1, Matieland 7602, Stellenbosch University, Stellenbosch, Republic of South Africa. Tel.: +27 (0)21 808 4721, E-mail: rev@sun.ac.za

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SPORT IN RUHLEBEN: 'N TOONBEELD VAN OORLEWING IN KRYGSGEVANGESKAP

Floris J.G. VAN DER MERWE
Departement Sportwetenskap, Universiteit Stellenbosch, Stellenbosch, Republiek van Suid-Afrika

ABSTRACT

Imprisonment occurred on an unprecedented scale during the First World War. The Ruhleben camp, with its more than 4000 British prisoners, is an excellent example of how sport served as a lifebuoy for their barbed-wire syndrome. From September 1915 the prisoners of war started establishing a self-governing community that later functioned like a little piece of England. Playing organised games or sport took root instinctively. Initially only soccer was played and was by far the most popular sport, as rugby was prohibited yet did make an appearance later. The main driving force behind it was the South African, Lt. J. Moresby-White. When it became too hot to play soccer, the prisoners of war played cricket and later also tennis. With 10 professional golfers in the camp, this sport was also popular. Other popular sports and games included athletics, hockey, boxing, physical drill, board games and gambling. One of the redeeming features of life in the Ruhleben camp was the well- organised nature of the prisoners' sport. The camp became a world in itself – for many the world. The fact that most of the people described captivity as a stimulating experience and that relatively few were affected negatively by it, can be attributed to the social climate in the camp.

Key words: First World War; Sport; Military; Prisoners of war; Ruhleben; Germany.

INLEIDING

Die Eerste Wêreldoorlog was die uitvloeisel van ou magstryde wat net deur ‟n oorlog opgelos kon word. Dit het dan inderdaad gevolg op die sluipmoord van aartshertog Franz Ferdinand in Sarajevo op 28 Junie 1914. Brittanje se toetrede tot die oorlog op 4 Augustus het gekom toe Duitsland vrye toegang deur België geëis het. Almal het gedink die oorlog sou gou verby wees (Orpen, 1970:74,75; Birley, 1986:288-310), maar dit sou vier jaar en 328 dae duur − van 1 Augustus 1914 tot 28 Junie 1919 (demobilisasie ingesluit) (Walsh,

1975:169). Suid- Afrika sou tydens die Eerste Wêreldoorlog ongeveer 20% van sy manlike bevolking aan die verskillende fronte ontplooi (Buchan, 1920:260,261), en uit die aard van die saak het talle van hulle in krygsgevangenekampe beland.

Gevangeskap tydens dié oorlog het aan beide kante ‟n ongekende skaal aangeneem. Dit word op 8.5 miljoen soldate geskat. Dit kan bereken word op een uit elke nege mans in uniform. Die meeste is aan die oostelike front gevangene geneem. In Duitsland alleen was 2.4 miljoen Geallieerde soldate al teen Oktober 1918 krygsgevange geneem (Jones, 2008:20). Suid-

Afrikaners is in een of ander stadium in minstens 24 van die ongeveer 174 kampe in Duitsland aangehou (SANMMH, n.d.).

RUHLEBEN-KAMP

Op 6 en 7 November 1914 is mense oral in Duitsland gearresteer en teen die einde van daardie maand is amper alle Britse burgers tussen die ouderdomme van 17 en 55 wat hulle in Duitsland bevind het, in die Ruhleben-kamp geïnterneer (Ellison, 1918:31). Ruhleben was ongeveer 10km buite Berlyn. Dié siviele kamp vir hoofsaaklik Britse geïnterneerdes is op ‟n perderenbaan ingerig. Altesame 4 500 (sic) Britte is in ‟n stadium hier in stalle en solders aangehou (SANMMH, n.d.:10).

Die Ruhleben-kamp is 'n uitstekende voorbeeld van hoe sport as reddingsboei vir die Eerste Wêreldoorlog-krygsgevangenes se oorlogsverdriet (oftewel doringdraad sindroom) gedien het. Die kampinwoners het uit al die vlakke van die samelewing gekom. Hulle was maar net op die verkeerde tyd op die verkeerde plek. Baie was sakelui wat deur die oorlogsverklaring in Duitsland betrap is; ander was studente en dosente/onderwysers; daar was ook blote vakansiegangers; professionele gholfspelers en perdejokkies; vakmanne in fabrieke wat die Duitsers die fynere kunsies van die Britse masjinerie kom leer het; en ‟n groot aantal skeepsbemanning (Smith, 2004:68,70).

Toegang tot die perderenbaan was aanvanklik streng verbode. Die inwoners kon net in die oop areas rondom die stalle (kasernes) wandel en oefen. Hierdie areas was kaal met los en selfs sanderige grond wat gou in die reënseisoen in ‟n modderpoel verander het. Daar was geen oppervlakdreinering nie en die laat herfs van 1914 was ‟n uiters reënerige tydperk (Powell & Gribble, 1919:1-4).

Andries Venter (Cohen, 1917:114)

So vêr vasgestel kon word, was die Suid-Afrikaners in die kamp mense soos Johannes Smuts, Frederick Karl Schmidt, Andries Venter, J. Moresby-White en waarskynlik ander. Andries Venter het baie aandag getrek. Met ‟n lengte van 6 voet 7½ duim (2.02m) (The Ruhleben story) was dit nie moeilik nie. Bronne verskil oor sy werklike lengte. Volgens die Sir John Masterman-versameling was hy 7 voet 6 duim (Harvard University Library) (2.286m) lank en volgens die webblad vir reuse was hy 7 voet 2 duim (2.184m) (The tallest man.com). Bronne verskil ook oor waar hy gevange geneem is. Die *Times* (1918:6) sê dit was in Dresden waar hy as "public entertainer" gewerk het en die Masterman-versameling sê dit was by die sirkus in Berlyn. Sy bynaam in die kamp was "Castle" en daar moes spesiaal vir hom ‟n bed in die "Tea-house" gebou word om op te slaap (Harvard University Library). Die ander geïnterneerdes was altyd jaloers op hom omdat hy die beste uitsig langs die voetbalveld gehad het (Cohen, 1917:116). Die Duitse media het blykbaar gereeld foto‟s van hom gepubliseer en hy het ook in ‟n Duitse stilrolprent opgetree, aangetrek soos ‟n Amerikaanse Rooihuid. Hierdie rolprent is in die somer van 1915 geskiet en heel eerste op 21 Augustus 1915 in die kamp vertoon met die opening van hulle nuwe bioskoop (Harvard University Library). Nog ‟n Suid-Afrikaner, lt. J. Moresby-White, was met vakansie in Duitsland toe die oorlog uitgebreek het. Tydens sy tweejaaraanhouding hier was hy die president van die Ruhleben Rugby Union (*Diocesan College Magazine*, 1919:35).

In September 1915 is 150 van die Duitse wagte onttrek en het die 4 000 geïnterneerdes ‟n selfregerende gemeenskap begin vorm. Van toe af het Ruhleben soos ‟n stukkie Engeland of klein Britse kolonie gefunksioneer (Ruhleben prisoner of war camp). Die speel van georganiseerde spele/sport was so deel van die Britse tradisie dat dit instinktief in Ruhleben posgevat het. Binne 24 uur ná hulle aankoms is ‟n bal geïmproviseer en het hulle daarmee gespeel. Duitse besware, sneeu en modder het in die winter ‟n einde aan dié aktiwiteite gemaak, maar vanaf Maart 1915, toe die speelveld per kontrak gehuur is, het sport

toegeneem (Ketchum, 1965:192).

Die kamplewe het die inwoners verskillend geaffekteer. Volgens Ellison (1918:39,40) was die eerste winter uiters beproewend vir almal. Volgens hom was dit die jonger geslag wat die uitwerking die minste gevoel het, want hulle het aan sport deelgeneem en so warm en fiks gebly. Daar was verskeie mense onder hulle, soos Steve Bloomer, Fred Pentland, Fred Spiksley en Samuel Wolstenholme, wat vir Engeland internasionale sokker gespeel het, John Cameron (vir Skotland), Edwin Dutton (vir Duitsland) en John Brearly ("n voormalige Everton- en Tottenham Hotspur-speler) (Ruhleben prisoner of war camp). Daarbenewens was daar ook "n groot aantal uitstekende amateurspelers. Voetbal (sokker) het "n baie gewilde spel geword en afleiding verskaf aan nie net die spelers nie, maar ook aan die groot aantal toeskouers. Kort voor lank het kasernes spanne saamgestel en het "n liga daaruit voortgespruit. Ander geïnterneerdes het vaardighede aangeleer soos tale, leerwerk, boekbindery, matte weef, ens. (hulle het selfs gepraat van die "Ruhleben University"), maar baie het ook niks gedoen nie.

Henry Charles Mahoney som die vroeë kamplewe soos volg op: "During the closing weeks of the year 1914 life at Ruhleben was intensely drab and dreary. There was nothing with which we could while away the many hours of enforced leisure" (Mahoney, 1918:127); "Killing time in those days constituted the most depressing feature of our existence" en "After breakfast, there being nothing else to do, we either lounged around … in an heroic effort to

kill time" (Mahoney, 1918:22) en die middae het baie soos die oggende verloop. Dit was onmoontlik om aan flinke staptogte deel te neem omdat daar te veel mense in "n klein ruimte ingehok was en ook omdat die grond tot "n see van modder vertrap is. Sommige het moeg geraak van die niksdoen en besluit om speletjies te speel, maar hulle het geen toerusting gehad nie. Vasberade om afleiding te skep, het hulle "n paar stukke ou lap en tou in die hande gekry en "n primitiewe lap bal daarvan gemaak. Hiermee het hulle soos skoolseuns "rounders" gespeel. Dit was die eerste afleiding in die kamp en "n groot sukses. Dit het toenemend gewild geraak toe "n gevangene "n rubberbal uit Berlyn bekom het. Dit was eers later dat hulle in staat was om hul begeerte om "n voetbal rond te skop, kon uitleef. Hulle het wel die roetine van "rounders" afgewissel deur die lap bal rond te skop. Op hierdie manier het hulle die middae tot 17:00 verwyl (Mahoney, 1918:22,23).

Hul harde leefwyse is vererger deur uiters gure weer in hul eerste winter, wat gesorg het vir "n epidemie van verkoues, griep en rumatiek. Toe die militêre medikus, dr. Geiger (Cohen, 1917:75; Powell & Gribble, 1919:148), elke oggend die vol gange buite sy spreekkamer sien, het hy besluit dat die inwoners ontspanning nodig gehad het. Die enigste oefening wat die meeste geïnterneerdes op daardie tydstip gekry het, benewens wandel op die paradegrond, was om toeskouers te wees by "n "rounders"-wedstryd in die ruimte tussen kasernes 2 en 11. Daarvoor het hulle boonop net koue voete gekry.

Die ontspanning wat deur die dokter voorgeskryf is, het stap om die renbaan (wat tot op daardie tydstip nog taboe was vir die gevangenes) behels. In plaas daarvan dat dit vir soggens geskeduleer is (wanneer hulle koud was en graag met oefening hitte wou opbou), moes hulle om 14:00 stap (voor hulle nog hul middagete kon verteer). Hierdie wandelings was verpligtend en "n gevangene kon net vrygestel word met "n doktersbrief. Daar was wel

"n aantal luies wat weggekruip het. Die wandeling het drie rondtes rondom die buitenste renbaan behels – "n totale afstand van drie myl (4.8km) (Cohen, 1917:75,76). Wim Hopford is op 16 November 1914 na Ruhleben en hy bevestig dit met: "Walk, walk, walk was the order of the day, there was no other means of keeping warm" (Hopford, 1919:96).

Volgens een van die inwoners, Israel Cohen, was die sportiewe instink van die Britse gevangenes só sterk dat hulle binne "n week in Ruhleben "n aantal voetbalklubs gestig het. Almal met bekende name soos Tottenham Hotspurs, Manchester Rangers, Bolton Wanderers en Newcastle United. Net een voetbal was beskikbaar, maar dit het geen afbreuk aan hulle geesdrif en groeiende belangstelling gedoen nie. Wedstryde is weke vooruit beplan. In daardie stadium was die speelveld "n groot oop ruimte binne die kampong. Die doelpale is met klippe en opgehoopte baadjies aangedui (Cohen, 1917:132). Hierdie geesdrif is nie lank daarna nie deur die Duitse kampowerhede gedemp. Die rede wat hulle aangevoer het, was dat die stalvensters beskadig kon word (*Ruhleben Camp News*, 1915:5).

Vanaf 15 Junie 1915 was daar spesiale kasernes vir seuns van 18 jaar en jonger (*The Ruhleben Camp Magazine*, 1916a:38). Dié jongelinge het tydens die eerste winter hulle eie buitemuurse speletjie opgemaak. Dit het behels dat twee geblinddoekte spelers mekaar met lappe probeer raakslaan het – tot groot vermaak van die omstanders. Hulle het dit meestal saans gespeel (Cohen, 1917:133). Mahoney (1918:127) verwys daarna as "tag". Daar was ook spele soos "prisoner"s base", "tip-cat" en "high-cockalorum" (Powell & Gribble, 1919:148).

Soos alreeds genoem was ruimte aanvanklik die grootste probleem. Benewens die wandel area voor die pawiljoen was net die smal oop ruimtes tussen die geboue beskikbaar vir ontspanning (Mahoney, 1918:127). Hiervan was "n area van 60 x 30 tree die grootste (Powell & Gribble, 1919:148). Hierdie area is verklein toe die owerhede nog twee kasernes daarop gebou het. Dit was die rede waarom georganiseerde sport in die kamp eintlik eers na die einde van Maart 1915 posgevat het toe die helfte van die binnenste renbaan vir die kampinwoners se gebruik beskikbaar gestel is. Hierdie half ovale terrein het "n area van 200 tree by 150 tree beslaan (SADF Archive, 1915:3; Ketchum, 1965:156).

Die geïnterneerdes het hulle so goed gedra dat die keiser se regterhand, genl. Von Kessel, tydens sy inspeksie op 20 Maart 1915 die toegewing gemaak het dat hulle die genoemde deel van die renbaan vir ontspanning kon gebruik. Dit was in reaksie op sy vraag of hulle enige klagtes of versoeke gehad het, waarop die behoefte aan "n ontspanningsterrein toe geopper is. Na baie onderhandeling is daar op die ou end toegegee en kon die geïnterneerdes slegs die helfte van die renbaan gebruik. Die verskoning was dat hulle gejuig en geskreeu die werkers in die militêre administratiewe kantore sou steur. Die kampinwoners moes egter huur aan die eienaars betaal. Daar is op £40 vir "n tydperk van ses maande besluit, wat verleng kon word. Op daardie tydstip het hulle nog gedink dat die kamp nie so lank gebruik sou word nie of dat die oorlog vroeg sou eindig (Powell & Gribble, 1919:149,150).

Hierdie vergunning, tesame met die koms van voedselpakkies uit Brittanje, het "n dramatiese omwenteling in die lewens van die geïnterneerdes in Ruhleben meegebring (Ketchum, 1965:93). Hierna is "n ontspanningskomitee in die lewe geroep (Powell & Gribble, 1919:150). Allerlei sportsoorte is op hierdie terrein beoefen, danksy The Ruhleben

Football Association, Cricket Association, Rugby Football Club, Lawn Tennis Association, Hockey Club, Boxing Club en Golf Club (Ketchum, 1965:194). Tydens sulke sportsessies het baie gevangenes ook nog buite om die toegekende area gewandel (Cohen, 1917:133).

Sokker

As deel van die feesviering oor bogenoemde toegewing is ‟n sokkerwedstryd gereël. Die twee spanne is onderskeidelik deur Bloomer en Pentland aangevoer en die kampkommandant, Baron von Taube, het die afskop in volle uniform en met die ewige sigaar in die mond behartig (Mahoney, 1918:134; Powell & Gribble, 1919:150).

‟n Komitee, The Ruhleben Football Association (*In Ruhleben Camp*, 1915e:9), is vir die sokkerspelers gestig en het bestaan uit verteenwoordigers van die verskillende kasernes. John Cameron, die voormalige bestuurder van Tottenham Hotspur, het as sekretaris opgetree en Fred Pentland as voorsitter (*In Ruhleben Camp*, 1915a:8; Ruhleben prisoner of war camp). Hulle taak was om die twee velde uit te meet, doelpale te bou, wedstryde te reël en die finansies te bestuur – die huurgeld was byvoorbeeld £50 (sic). Later is ander komitees vir die ander sportsoorte in die lewe geroep. Verteenwoordigers van hierdie onderskeie komitees het die sportbeheerkomitee uitgemaak, wat die vorige ontspanningskomitee vervang het (Cohen, 1917:133,134; Mahoney & Talbot, 1917:293). Die nuwe beheerkomitee het bestaan uit G. Fisher (voorsitter), J. Swift (onder-voorsitter), R. Revill (sekretaris), G. Dix en dr. Jephson (liggaamsoefeninge), J. O‟Hara Murray (tennis), F.B. Pentland (sokker), [J.] Moresby-White

(rugby), T. Sullivan (atletiek) (Powell & Gribble, 1919:150) en J.C. Masterman (krieket & hokkie) (*In Ruhleben Camp*, 1915e:38).

Van al die genoemde sportsoorte was sokker die gewildste (Cohen, 1917:134; Powell & Gribble, 1919:157). Lidmaatskap was oop vir almal wat wou saamspeel en spoedig kon elke kaserne ‟n knap span in die veld stoot (Mahoney, 1918:135). Baie van sokker se gewildheid moet toegeskryf word aan die teenwoordigheid en insette van die twee reeds genoemde internasionale spelers, by name die 41-jarige Steve Bloomer en Fred Pentland. Hulle was juis besig om die Duitse jeug sokker te leer toe die oorlog uitgebreek het (Cohen, 1917:133,134; *In Ruhleben Camp*, 1915f:19). Dit was hulle wat vriende tuis om ‟n bal gevra het en met die koms daarvan was die kamp oorstelp van vreugde. Skielik het die kamplewe ‟n heel ander dimensie aangeneem en het moraal die hoogte ingeskiet (Mahoney, 1918:133).

Dit is insiggewend dat die kamplede self die spanne gekies het. Meer as 1 600 kampinwoners (amper die helfte van die kamp) het as keurders opgetree (*In Ruhleben Camp*, 1915e:8). Twee ligas is gevorm en hulle het tot 8 Mei 1915 gereeld gespeel. Die eerste en tweede liga is uit die eerste en tweede spanne uit 14 kasernes saamgestel (*In Ruhleben Camp*, 1915a:9). Elkeen het sy eie unieke kleure gedra (Cohen, 1917:134). Hierdie standaarduitrustings in kenmerkende kasernekleure is uit Brittanje bekom. Niks minder as agt liga wedstryde is per dag geskeduleer en die kampinwoners het dit goed ondersteun (Ketchum, 1965:11, 227).

Benewens bogenoemde sokkerligas, was daar ook ‟n kompetisie wat hulle die “Cup

Competition" genoem het. Dit het 14 inskrywings gelok, maar daar was nie regtig ‟n beker op die spel nie. Hulle het net gedink dat dit beter as ‟n uitkloptoernooi sou klink. Daar is volgens dieselfde reëls as dié van die Engelse Beker-kompetisie gespeel (Cohen, 1917:134,135; *The Ruhleben Camp Magazine*, 1917:56). Samuel Wolstenholme, kaptein van die seëvierende kaserne 9, het gesê hy weet nie wat hulle sonder hul sokker sou gedoen het nie (*In Ruhleben Camp*, 1915f:18).

Rugby

Aan die begin is net sokker gespeel. Rugby is aanvanklik verbied omdat dit blykbaar te robuus was en "not at all a nice game" (*In Ruhleben Camp*, 1915a:12), maar het tog later sy verskyning gemaak. Dit was blykbaar ‟n belewenis om die geïnterneerdes wat nog nooit die spel gesien het nie, se kommentaar te hoor (Cohen, 1917:134). Die rugbyklubs het name gehad soos Barbarians (kaserne 10), Blackheath (kaserne 8), Wasps (kasernes 5 en 11), Harlequins (kaserne 3 en die houtkasernes), United Services (kasernes 4 en 9), en Nomads (kasernes 2 en 7) (*In Ruhleben Camp*, 1915e:32; Cohen, 1917:134). Hulle het sedert 5 April 1915 gereeld gespeel totdat die warm weer aangebreek het (Ketchum, 1965:193). Hulle kon ‟n ou sokkerveld van die sokkervereniging bekom wat groter was as ‟n standaard sokkerveld. Daar was geleentheid vir vier oefenwedstryde per week. Dit het vir diegene wat nie in die senior spanne gespeel het nie, ook „n speel kans gebied (*In Ruhleben Camp*,1915e:32).

Die voorstel van Alfred Mills dat die kampinwoners die spanne moes kies, was ‟n groot sukses. In daardie week van voorbereiding kon alle spelers goed deurgekyk word en is die spanne deur die kampkoerant bekend gemaak (*In Ruhleben Camp*, 1915e:9,10). Ten spyte daarvan dat die eerste seisoen ‟n korte was, was dit ‟n groot sukses en is dit met ‟n reeks

"internasionale" wedstryde tussen Engeland, Ierland, Wallis en ‟n gekombineerde span van Skotte en koloniale spelers afgesluit. Die Suid-Afrikaner, Moresby-White, was die kaptein van laasgenoemde.

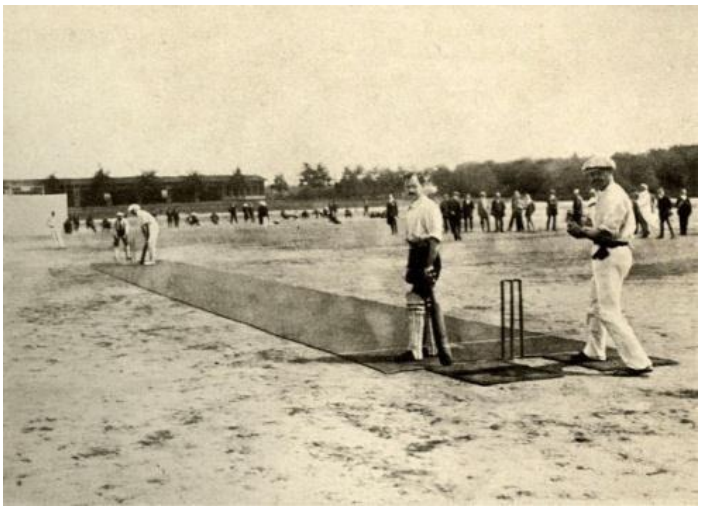
> "The Scots-Colonial side, although beaten by Wales, was in my opinion much the best team and produced some very brilliant players, of which of course Moresby- White was first. His captaincy did much to make the team what it was, and the play in the match versus England reached a very high standard."
> (*In Ruhleben Camp*, 1915b:22).

Die sukses van dié eerste rugbyseisoen in Ruhleben was aan twee spelers, J. Moresby-White en S.H. Gudgeon, te danke. As dit nie vir hulle was nie, sou rugby waarskynlik nooit in die kamp gespeel gewees het nie (*In Ruhleben Camp*, 1915b:22).

Krieket

Sokker was die gunstelingsport totdat die weer te warm geraak het. Dan het die krieketseisoen begin. Met die verkryging van kolwe, balle en paaltjies uit Duitsland en Brittanje, is almal in die kamp genooi om vir ‟n sikspens lid van die klub te word. Soos met sokker is hier ook interkaserne wedstryde (ligas) gereël wat tot die einde van September geduur het (voordat die sokkerliga weer ‟n aanvang geneem het). Om die veld nie die hele dag te beset nie, is dié wedstryde slegs in die middae gespeel. Dit het drie ure soggens

gelaat vir ander aktiwiteite, sowel as netoefeninge vir die krieketspelers (Mahoney, 1918:147; Ketchum, 1965:193). Dié nette is vroeg in Junie 1915 opgerig (*In Ruhleben Camp*, 1915a:4). Daar is in twee afdelings gespeel en twee kolfblaaie, met matte, was tot hul beskikking (Cohen, 1917:135). Geen spykerskoene is op die kolfblaaie of in die nette toegelaat nie (*In Ruhleben Camp*, 1915c:15).



Krieket in Ruhleben
Let op die mat as kolfblad (Cohen, 1917:134).

Die krieketspelers het groot moeite gedoen om in flanelbroeke te speel, terwyl die skeidsregters die tradisionele lang witjas gedra en amptelike Britse telboeke gebruik het. Dit,

tesame met die raserige prosessie van sekere kasernes na die speelveld, begelei deur hul gelukbringer, en die plegtige applous vir elke span aan die einde van ‟n wedstryd, het die kamp sport so „eg‟ gemaak dat die deelnemers hul nuwe rolle met oortuiging kon vervul (Ketchum, 1965:227).

Tennis

Tennis was ‟n ietwat latere toevoeging tot Ruhleben-sport (*In Ruhleben Camp*, 1915d:20). ‟n Gedeelte van die asbaan is vir die speel hiervan opsy gesit en hiervoor moes die klub £50 betaal (Mahoney & Talbot, 1917:293). Die eerste baan is op 16 Julie 1915 voltooi (*In Ruhleben Camp*, 1915d:20). Altesame drie bane was uitgelê, maar dit was nie genoeg nie en nog vier het spoedig gevolg. Dit het die kampinwoners sewe bane gegee (Mahoney, 1918:139) wat nie vir 10 minute op ‟n slag onbenut was nie (*In Ruhleben Camp*, 1915d:20). In die 1916-seisoen is dit selfs na nege vermeerder (*The Ruhleben Camp Magazine*, 1916b:42). Die nette en ander toerusting is van ‟n Duitse firma gehuur. Tog was die spel nie almal se gunsteling nie. Dit is deur baie beskou as die spel vir die “elite” van die kamp. Ander het dit weer as te dooierig of te feministies beskou. Daarbenewens was die spel te eksklusief en was die ledegeld een ghienie vir die seisoen, wat dit buite die bereik van baie gevangenes geplaas het (Manoney, 1918:139).

Dié bane op die perderenbaan is deur nette geskei. Omdat dit onmoontlik was om die bane noord-suid uit te lê, moes die spelers die ongerief van son in die oë sowel as die effense helling van die baan verduur (*In Ruhleben Camp*, 1915d:20; Cohen, 1917:137). Die bane was nietemin so gewild dat daar byna nooit een leeggestaan het nie (Cohen, 1917:138; Ketchum, 1965:193). Die Suid-Afrikaner, Moresby-White, was een van die geesdriftigste spelers (*In Ruhleben Camp*, 1915d:20-21). Die junior Duitse offisiere was heel beïndruk met dié spel en het die spelers soms toegelaat om voort te speel al het die klok gelui wat die ontruiming van die veld aangedui het (Powell & Gribble, 1919:163). Al nadeel van dié sport was dat diegene wat nie oor die nodige finansies beskik het om die duur lidmaatskap te betaal en raket, bal en skoene te koop nie, daarvan uitgesluit was (Cohen, 1917:138).

Gholf

Die meerderheid professionele gholfspelers wat in Duitsland by die sport betrokke was, was in die kamp (*Ruhleben Camp News*, 1915:5; Ruhleben prisoner of war camp). Professor Bywater se beskrywing van "pushing balls into little holes with implements ill adapted to the purpose" (Powell & Gribble, 1919:164), het nog meer betrekking op Ruhleben, want van die professionele gholfspelers het hul eie stokke gemaak. Gholfballe kon hulle darem uit Engeland bekom. Ná die gholfspelers menige ruite in die kamp stukkend geslaan het, het hulle ook op ‟n deel van die veld aanspraak gemaak (Powell & Gribble, 1919:163). Gholf is later, nadat die toegewing gemaak is, op die verste punt van die renbaan gespeel. Omdat die veld hoofsaaklik deur die voetbal- en krieketspelers beset is, moes die gholfspelers binne sekere perke bly. Nou en dan is die hele veld vir ‟n paar dae vir hul gebruik gereserveer en kon hulle ‟n kampioenskapstoernooi organiseer. So ‟n toernooi het byvoorbeeld op Sondag 12 September 1915 begin en drie dae geduur, met 12 gate wat per dag gespeel is (*In Ruhleben Camp*, 1915a:24; *In Ruhleben Camp*, 1915e:17; Cohen, 1917:139).

Op 27 April 1915 het die spelers verlof gevra om vir ‟n uur soggens (tussen 08:00 en 09:00) die terrein vir hulself te kon hê. Dit is so ooreengekom (Powell & Gribble, 1919:163,164). Ná hierdie uur was die veld vir al die ander geïnterneerdes se gebruik en mag die gholfspelers nie meer hul drywers gebruik het nie. Geen gevangene is aanvanklik toegelaat om lid van die gholfklub te word indien hy nie bevredigende bewys kon lewer dat hy ‟n lid van ‟n erkende gholfklub in sy tuisland was nie (Mahoney, 1918:139).

Hulle het sedert 30 April 1915 op ‟n vyfgaatjiebaan met "criss-crossing fairways" gespeel (Ketchum, 1965:193). Die spel is natuurlik onder baie onkonvensionele toestande gespeel. Die spelers het meestal van kort houtjies en setwerk gebruik gemaak. Leë kondensmelk-blikkies is in die grond begrawe om as putjies te dien (Mahoney, 1918:138). Op ‟n baan van 250 by 100 tree en ‟n oppervlak van meestal sand met hier en daar ‟n paar polle gras en fynbos (heide), het dit nietemin vir groot pret gesorg (Powell & Gribble, 1919:164).

Beginners kon wel later baat vind by die lesse wat die professionele spelers aangebied het. Sommige van hierdie beginners het oor die bestek van vier jaar in uitstekende spelers ontwikkel. In een van die toernooie het twee skeepskapteins wat voor die oorlog nooit aan ‟n gholfstok geraak het nie, met die trofee weggestap (Powell & Gribble, 1919:164). In teenstelling met wat Mahoney geskryf het, noem Cohen dat baie kampinwoners inderdaad hul eerste lesse in die kamp ontvang het.

Atletiek

Atletiek is ook nie afgeskeep nie. In die tydperk tussen die voetbalseisoen en die aanvang van die krieketseisoen is atletiek beoefen. Hierdie aktiwiteite het oor twee weke gestrek en op Ryksdag (Empire Day, 24 Mei 1915) geëindig. Die baan is sorgvuldig uitgemeet en die deelnemers het in kenmerkende kleure deelgeneem met prominente nommers op die bors en rug. Die afsitter het selfs ‟n rewolwer gebruik (Cohen, 1917:137). ‟n Sportkomitee is vir hierdie doel in die lewe geroep en het tot een van die grootste en belangrikste komitees in die kamp gegroei (Mahoney, 1918:140,141).

Hierdie Ryksdag program van 1915 het uit die volgende nommers bestaan: "golf driving, drill class display, 100 yards open, two miles walking contest, 75 yards old age handicap, 75 yards open, 100 yards jockeys handicap, half-mile open, 220 yards open, quarter mile open, one mile open, 100 yards handicap, 120 yards hurdles open, three legged race open, running high jump, tug-of-war, relay race – one mile open" (*In Ruhleben Camp*, 1915a:18). Die uitslae het baie goed vergelyk met dié van voor die oorlog, veral as die omstandighede soos die terrein en die gebrek aan voorbereiding in ag geneem word. Onder die bespreking van die uitslae in die *In Ruhleben Camp*-koerantjie word daar komies na die gunsteling deelnemer in die gewigstoot, mnr. Alison, verwys. Hy was die tandarts en daar is bespiegel dat die trek van tande sy spiere geoefend gehou het. Die aand ná dié verrigtinge het Barones von Taube die prysoorhandiging behartig (Powell & Gribble, 1919:152,153). Ketchum (1965:193) vertel van ‟n uitnodigingswedloop oor 100 tree wat in April 1915 soveel belangstelling gelok het dat een wedder nie in staat was om uit te betaal nie. ‟n Interessante verskynsel is byvoorbeeld dat die atletiek program vroeg in 1916 die volgende springnommers bevat het: "running long jump, standing long jump, running high jump, standing high jump" (*The Ruhleben Daily News*, 1916a:n.p.).

In Augustus 1917 is die "Ruhleben Camp Sports" gehou. John Masterman se versameling toon foto‟s van die eenmylwedren, 100-tree voorgee finaal, 75-tree veterane-resies se vierde uitdun, 75-tree veterane se semi-finaal, 120-tree voorgee finaal, driebeenresies finaal, veterane-resies finaal, halfmyl voorgee, en die 120-tree voorgee semi-finaal (Harvard University Library records: 220-222, 224-229).

Hokkie ("Field hockey")

Hokkie het op 25 April 1915 begin en is vir drie daaropvolgende seisoene gespeel (Ketchum, 1965:193). Weens die klimaat en fisiese toestande, moes die Ruhleben-hokkiespelers noodgedwonge energieke eerder as akkurate hokkie speel. Anders as in die geval van die ander spanspele is die speel van hokkie meer belemmer deur modder en poele water. Aan die positiewe kant het dit die veld vir vaardige en minder vaardige spelers gelyk gemaak (*The Ruhleben Camp Magazine*, 1916a:34).

Boks

Omdat daar ‟n aantal knap boksers en boks entoesiaste in die kamp was, het die sport gou gewild geword die oomblik toe die nodige toerusting aangekom het (Mahoney, 1918:132). Daar was ‟n boksklub, „Wonderland‟ gedoop en deur "Cobbler" bestuur, wat gereeld vertonings gelewer het (Sladen, 1917:251). „Wonderland‟ was tussen kasernes 4 en 8 geleë

(*In Ruhleben Camp*, 1915c:30). Die meeste van die gevegte het uit drie rondes van een minuut elk bestaan (Cohen, 1917:139). Hierdie goed georganiseerde boksgevegte het deur die dag plaasgevind. Die oomblik toe ‟n kryt opgerig is, het bokstoernooie een van Ruhleben- kamp se kenmerke geword (Mahoney, 1918:132). Die boksklub het lesse teen ‟n lae prys aangebied en toegang by gevegte was een mark (*In Ruhleben Camp*, 1915c:31).

Volgens Henry Charles Mahoney het die Duitse kampowerhede hierdie aktiwiteit onder protes aanvaar "… the greatest resentment was manifested because we were fostering and developing the great British tradition – the fighting instinct" (Mahoney, 1918:133). Op 7 Augustus 1916 is die tweede "August Bank Holiday" in die kamp gevier. Vir die klub was dit "Boxing Day". Na wat berig is, was die toernooi ‟n groot sukses en baie toeskouers het die groot pawiljoen gevul om die gevegte te sien. Volgens die rubriekskrywer van die kampkoerant was dit die beste amateur gevegte wat hy nog aanskou het (*The Ruhleben Daily News*, 1916b:1). Alle dank vir hierdie inisiatief het aan Tom Sullivan gegaan. Hy het ook skerm- en stoeivertonings vir hierdie geleentheid gereël (*The Ruhleben Camp Magazine*, 1916c:1).

Liggaamsoefeninge ("Physical drill")

Onder die geïnterneerdes was daar heelwat akrobate en gimnaste. Een van die gevangenes is die Kat ("Cat") gedoop. Uit Cohen (1917:137) blyk dit dat dié "Kat" ene G. Dix was. Hy het sedert sy aankoms elke dag getrou sy Sweedse stelsel van statiese liggaamsoefeninge uitgevoer. Sy toewyding en gesondheid het almal se bewondering afgedwing. Hy het derhalwe onderneem om die ander ook te onderrig. "The displays of his class constituted one of the most widely appreciated diversions of the community…" en sy groep het aangegroei tot 80 lede (Mahoney, 1918:130,131). Teen die middel van 1915 het meer as 100 lede elke oggend die "physical jerks" meegemaak (Ketchum, 1965:193).

Bordspele

In die vroeë dae van die kamp is die inwoners slegs toegelaat om spele, soos skaak, tussen aandete en slaaptyd te speel (Smith, 2004:68). In hul soeke na afleiding het menige hul toevlug tot skaak geneem. Dit het meegebring dat ‟n skaakepidemie in die kamp uitgebreek het (Cohen, 1917:77). ‟n Skaakvereniging is gestig (*Ruhleben Camp News*, 1915:5) en so is menige vervelige aand verwyl (Cohen, 1917:77). Dit was natuurlik nadat hulle al een of twee kerse per kaserne ontvang het dat hulle die aande beter kon benut (Mahoney, 1918:146). Die beskikbaarstelling van die veld het ook die "Grand Stand Hall" ingesluit, maar teen huurgeld van £50. Dit was sedert die uitbreek van die oorlog in onbruik en die kampinwoners het dit toe in ‟n teater omskep (Mahoney & Talbot, 1917:293). Hierdie saal onder die pawiljoen het in vredestyd as ‟n verversingslokaal vir die renbaan besoekers gedien, maar was nou die middelpunt van die geïnterneerdes se lewens. Hulle het óf gesit en lees, óf gerook, óf mekaar vreemde tale geleer óf skaak of ander spele soos dambord gespeel (Cohen, 1917:77,78).

Dobbel/weddenskappe/kaartspeel

‟n Ander vorm van opwinding was weddenskappe. Dit het oor al die sosiale klasse gestrek. Daar is gewed oor die uitslag van ‟n sportwedstryd, die koms van ‟n vriend se pakkie, die val van die Dardanelle, of Verdun, of oor die duur van hul gevangeskap, selfs die duur van

die oorlog. Alhoewel weddenskappe amptelik verbied was, is dit goed ondersteun. Daar was natuurlik ook die weddery met kaarte en party gevangenes het selfs klein roulette-tafels gebou (Cohen, 1917:192). Die verbod op wedenskappe is omseil deur in die skuiling van hulle private "horse-boxes" of onder beskerming van ‟n wag dié aktiwiteite te beoefen. In ‟n stadium is daar ernstig gedobbel (Mahoney, 1918:111,112). Met die koms van die eerste somer in die kamp, Junie 1915, is kaartspeel toegelaat, maar dobbel was steeds verbode. Dié verbod is, soos reeds genoem, gereeld oortree (Cohen, 1917:128).

Ander sportaktiwiteite

In Januarie 1915 het die kampkoerant berig dat ‟n liga vir "**rounders**" gestig is en dat wedstryde alreeds daagliks om 09:30 en 14:00 plaasgevind het. Die inwoners is gevra om weg te bly van die veld (speelterrein) en nie aan die bal te raak nie (*Ruhleben Camp News*, 1915:5). Vanaf 1916 het die Kanadese gevangenes ook nog Sondae bofbal geniet (Cohen, 1917:139; Ketchum, 1965:193).

Lacrosse en *la pelote* is ook in een hoek van die veld gespeel. Laasgenoemde was veral die Belge en Noord-Franse se gunsteling. "Bowling and horse-shoe pitching were unknown, but a form of skittles, played in the compound with sawn-off chair legs, was a pastime of the older seafarers" (Ketchum, 1965:193). **Skerm** het later sy opwagting gemaak (Ketchum, 1965:193). In John Masterman se versameling is ‟n foto van die "Ruhleben School of Fencing" wat in Maart 1918 geneem is en waarop sewe mans met hulle florette verskyn. Op
‟n ander foto uit dieselfde tydperk is twee mans besig om te skerm terwyl twee toekyk (Harvard University Library records: 254,255). Dit is die enigste bewyse wat die teenwoordigheid van skerm bevestig.

Verder was daar individue wat met handgewigte of Indiese knuppels geoefen het. Die sportkomitee het ook ‟n brug vir die gimnaste verskaf. Ander tydverdrywe was ringgooi ("quoits") en kroukie (Cohen, 1917:139).

SAMEVATTING

Ten slotte kan gemeld word dat die standaard van sport in die kamp hoog was. Die voetbalspan het byvoorbeeld oor ‟n aantal internasionale spelers beskik en sou in die Britse bekerliga kon speel sonder om skandes te maak. Heelwat van die krieketspelers het vir universiteite of graafskappe gespeel. Ook in die gholf geledere was daar talle professionele spelers (Powell & Gribble, 1919:151). Sladen sluit sy hoofstuk oor sport in Ruhleben af met "… there is no surer passport to being influential and respected in the Ruhleben Camp than proficiency in sports" (Sladen, 1917:252).

Die lewe in die onderskeie krygsgevangenekampe tydens die Eerste Wêreldoorlog het aansienlik verskil. In hierdie verband word verwys na die kampe in Oos- en Suidwes-Afrika teenoor dié in Duitsland. In Afrika was die kamplewe minder georganiseerd en het die klimaat ook beduidend verskil van dié in Europa. In die Europese kampe het die Britse kultuur ook ‟n groter rol in die kamplewe gespeel as in Afrika. Die krygsgevangenes in Duitsland is ook baie langer in die kampe aangehou as wat die geval in Afrika was (omdat die oorlog daar langer geduur het).

In Duitsland het die betrokke kamp en sy owerheid ‟n gevangene se lot bepaal. Behandeling was nie konsekwent en streng volgens die internasionale reg of selfs humanitêre beginsels nie (vergelyk Den Haagse Konvensie van 1899 en 1907). Die behandeling van Britse gevangenes was ook strawwer as dié van ander nasies. Met betrekking tot ontspanning/vermaak, is die krygsgevangenes in Duitsland wel een of ander vorm van ontspanning toegelaat (SAW Argief, 1915:2,31). Kampe soos Ruhleben en Holzminden het YMCA-ontspanningshutte gehad wat ‟n groot rol in hierdie verband gespeel het (Proctor, 2010:228). Volgens Desson straf gevangeskap soos hierdie die persoon op drie maniere. Eerstens is daar die ontneming van vryheid − wat sielkundig ‟n baie groot straf is. Dan is daar die verlies van liefde en teerheid en derdens die gedwonge ledigheid met sy dodelike onaktiwiteit. “When the prisoner first enters his cell, the most merciless of executioners enters behind him; his name is boredom” (Desson, 1917:90).

Die eentonigheid van die kamplewe lei tot verveling wat weer sielkundige letsels kan laat. Selfs in ‟n kamp soos Ruhleben, waar baie afleiding was, kon dit gebeur. Hulle moes elke oggend om 06:30 opstaan en dan by die kraan toustaan om waswater te kry. Om 07:00 was dit tyd vir parade en dan toustaan by die ketelkamer vir warm water vir ontbyt, daarna toustaan vir ‟n koerant, toustaan vir ‟n pakkie of biblioteekboek of teaterkaartjie, dan ‟n paar uur vir lees, studeer, sportdeelname of drentel voordat hulle weer moet toustaan vir middagete. Daarna saamdrom om die posbode, en dan toustaan by die kantien vir suiker, kaas of sardientjies, dan toustaan by die winkel vir sigarette, dan weer toustaan by die koerantstalletjie en vandaar weer na die ketelkamer vir warm water vir aandete. In die aand was dit ‟n lesing of konsert of speel gevolg deur wandel om die aangewese roete totdat die klok vir parade lui. Slaaptyd was om 21:00. Daar is selde van hierdie patroon afgewyk (Cohen, 1917:190).

Wat Desson verswyg het, is die vernedering waaraan die krygsgevangenes in sommige kampe onderwerp is. Dit is gedokumenteer dat die Duitsers hul Britse gevangenes brutaal behandel het, veral aan die begin van die oorlog toe hulle nog gedink het dat oorwinning binne bereik was (Anon, 1916:420). Hier is van Britse bronne gebruik gemaak, daarom is vooroordeel nie uitgesluit nie.

Langdurige gevangeskap het nie op almal dieselfde uitwerking gehad nie. Die mate waarin die omstandighede ‟n krygsgevangene sou beïnvloed, het afgehang van sy intellektuele vermoë, sy morele karakter en sy persoonlike omstandighede. Afgesien van die verlies van vryheid, was daar ander bedreigings soos die afsondering van die buitewêreld, die beperking en sensor van private korrespondensie, die konstante kommer oor die onsekere toekoms, die daaglikse eentonige lewe en verveeldheid (soos reeds genoem), die getroudes se kommer oor hul vrouens en kinders tuis en diegene wat afgesny was van hulle besighede of professies waarvan hulle geldelik afhanklik was. Dit sou van elkeen se persoonlike karakter afhang of hierdie faktore hom sou onderkry of nie (Cohen, 1917:189). Cohen sou hier nog hulle gebrekkige dieet, swak higiëne en mediese versorging ook kon byvoeg.

Aan die begin van hul gevangeskap het die soldate nog hul aandag gevestig op voedsel, hul fisieke toestand en die moontlikheid van vrylating. Na ‟n paar maande het ‟n paradigmaskuif plaasgevind. Die kamp aktiwiteite het toe opgehou om eenvoudige tydverdrywe te wees en vir baie het dit absorberende en gewaardeerde aktiwiteite geword

(Ketchum, 1965:213). Een van die verlossende eienskappe van byvoorbeeld die lewe in die Ruhleben-kamp, was die goed georganiseerde karakter van die krysgevangenes se sport. Vir die oningeligte mag dit lyk asof hulle ‟n vreeslik aangename tyd gehad het, maar dié aktiwiteite was eerder ‟n noodsaaklikheid as ‟n luukse (Cohen, 1917:132). Hulle het besef dat ten einde te oorleef hulle die kamp (in hierdie geval Ruhleben) so na as moontlik volgens hul eie Britse tradisies moes bestuur. Hulle moes dus ‟n stukkie tuiste reg in die hart van die vyand skep. Alles het van hulself afgehang (Mahoney, 1918:80,106).

Diegene wat hul heeltyd verknies het oor hul hopelose situasie sou emosionele siekte toestande ervaar, in teenstelling met dié wat by die kamp organisasie betrokke geraak het. Orde in die kampe was nodig om moontlike chaotiese situasies te ontlont. So byvoorbeeld sou Ruhleben se 4 000 inwoners nie sinvolle benutting van die veld en die gevolglike geestelike waarde gehad het as dit nie vir die skepping van ‟n sportbeheerliggaam en sy onderliggende klubs en spanne was nie. Hierdie geïnstitusionaliseerde karakter sedert Maart 1915 was een van die vroegste faktore op die weg van geestelike stabilisering van die gevangenes. Elke sport ondersteuner het geweet wanneer sy span sou speel. Hy het dus in ‟n beter georganiseerde wêreld geleef en was daarom minder vatbaar vir geestelike druk (Ketchum, 1965:220,221).

Die waarde van ‟n sportterrein vir hul alledaagse lewens het eers na vore gekom toe dit vir byvoorbeeld strafdoeleindes gesluit was. Honderde het dan doelloos rondgedrentel en iets gesoek om die tyd mee te verwyl. Dit was veral vir dié gevangenes wat nie tyd aan studies of lees bestee het nie, die enigste gesonde ontvlugting. Sport was ook vir die toeskouers wat weens wonde, beserings of gestremdhede nie aan sport kon deelneem nie, ‟n ontvlugting (*In Ruhleben Camp*, 1915f:15).

Dit vergestalt die wêreld wat hulle vir hulself geskep het. Hulle het ‟n netwerk van sosiale aktiwiteite tot stand gebring wat so omvangryk en absorberend was dat die kamp ‟n wêreld op sigself geword het – vir baie dié wêreld (Ketchum, 1965:192). Tog kon baie nie die depressie afskud wat met hul inhegtenisname ingetree het nie. Hulle het stadig weggesink in
‟n toestand van ongeneesbare swaarmoedigheid. Diesulkes het na twee jaar in die kamp dit steeds onvanpas gevind om vermaak of sport by te woon. Volgens Cohen (1917:110,192) het hulle genot gevind in hul “moping and brooding”. Hulle het die pret- en plesiermakery in die kamp in tye waarin hulle land bedreig word, verdoem (Powell & Gribble, 1919:164,165). Een so ‟n karakter in Ruhleben was voor die oorlog ‟n hinderniswedrenjokkie. Hy het in hierdie sielsieke toestand verval en gereeld in sy jokkiedrag verskyn, om die renbaan gehardloop en met sy “perd” oor denkbeeldige hindernisse gespring (Ellison, 1918:51).

Die feit dat die meeste mense die gevangeskap as ‟n stimulerende ervaring beskryf het en dat relatief min negatief daardeur geraak is, kan toegeskryf word aan die sosiale klimaat in die kampe. Sport, vermaak en studies het veroorsaak dat hulle ‟n doelgerigte lewe kon lei en daardeur hulle geestelike integriteit kon behou (Ketchum, 1965:210). ‟n Krygsgevangene in, sê maar ‟n kamp soos Ruhleben, het ‟n paradoksale lewe gelei. Hy was ingeperk én vry. Hy was onder militêre toesig, maar elke dag met vakansie. Hy was onder beheer, maar toegegooi met opsies waaraan hy kon deelneem. Dit was ‟n nuwe en besielende ervaring van vryheid. Hulle is uit een sosiale gemeenskap (wêreld) verwyder en

het onder moeilike omstandighede daarin geslaag om ‟n ander een te skep (Ketchum, 1965:220,229). Hulle het hulle nuwe wêreld so getrou moontlik aan hulle oue ingerig. Kasernes en ander sosiale bymekaarkom plekke in die kamp is na hulle tuistes vernoem. Saam met sport het dit ook gehelp om ‟n gees van kameraadskap te skep (Proctor, 2010:32,231). Percy Close som sy tyd as ‟n krygsgevangene soos volg op:

> "The experience we had passed through was a grand one, but not one to be wished for again. It made men of some, and brought out all that was good or bad in us; but with every one of us it fathomed the depth of our love for South Africa as our home, the intensity of which we had never before so fully realised."
> (Close, [1916]:312).

Hierdie artikel kan as 'n tipiese voorbeeld dien vir Erving Goffman se "total institution". 'n Term wat hy al in 1957 geskep het en waarmee hy verwys het na 'n plek waar 'n groot aantal mense vanuit 'n soortgelyke situasie (in hierdie geval die Eerste Wêreldoorlog) vir 'n onbepaalde tydperk van die groter gemeenskap afgesny is en onder bewaking en agter grense 'n formeel geforseerde en geadministreerde lewe moes voer (Goffman, 1968:xiii).

SUMMARY

Imprisonment occurred on an unprecedented scale during the First World War. An estimated one out of every nine men was in uniform. In Germany alone 2.4 million soldiers had been captured by October 1918. At some stage South Africans were interned in at least 24 of the 174 camps in Germany.

The Ruhleben camp with its more than 4000 British prisoners is an excellent example of how sport served as a lifebuoy for their barbed-wire syndrome. From September 1915 the prisoners of war started establishing a self-governing community. After that Ruhleben

functioned like a little piece of England or small British colony. Playing organised games or sport was so much part of the British tradition that it took root instinctively. Within 24 hours of their arrival a ball was improvised, with which they played. German objections, snow and mud in winter brought an end to these activities, but after March 1915, when the playing field was leased on the racecourse, sport flourished.

Soccer was by far the most popular sport and several international and professional players participated. Three leagues helped tremendously to kill time. Initially only soccer was played, as rugby was prohibited. Apparently it was considered too robust a game, yet it did make an appearance later. The main driving force behind it was the South African, Lt. J. Moresby- White. When it became too hot to play soccer, the prisoners of war played *cricket*. The cricketers went to a great deal of trouble to wear flannel trousers, while the umpires wore the traditional long white coat and used official British score books. This, together with certain barracks‟ noisy procession to the field, accompanied by their mascot, and the applause for each team at the end of a match, made the camp sport so "real" that the participants were able to fulfil their new roles convincingly. *Tennis* was a later addition and no fewer than nine courts were eventually laid out. With 10 professional *golfers* in the camp this sport was also popular and a five-hole course was laid out. Other popular sports and games included athletics, hockey, boxing, physical drill, board games and gambling.

The monotony of camp life led to boredom, which in turn could result in psychological damage. One of the redeeming features of life in the Ruhleben camp, for example, was the well-organised nature of the prisoners‟ sport. For the unenlightened, it might seem as if they had a most enjoyable time, but these activities were a necessity rather than a luxury. They realised that in order to survive they had to manage the camp as closely as possible in line with their own British traditions. They therefore had to create a little bit of home right in the midst of the enemy. They established a network of social activities that was so comprehensive and absorbing that the camp became a world in itself – for many *the* world.

The fact that most of the people described captivity as a stimulating experience and that relatively few were affected negatively by it, can be attributed to the social climate in the camp. Sport, entertainment and studies helped them to lead a purposeful life and thus retain their mental integrity. This article is illustrative of the classic total institution as defined by Erving Goffman in 1957.

Erkenning

Hierdie artikel is gegrond op navorsing wat finansieel deur die Nasionale Navorsingstigting (NNS) gesteun is. Enige menings, bevindings, gevolgtrekkings of aanbevelings hierin uitgespreek is dié van die skrywer en die NNS aanvaar dus geen aanspreeklikheid ten opsigte daarvan nie.

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Prof. Floris J.G. VAN DER MERWE: Departement Sportwetenskap, Universiteit Stellenbosch, Privaatsak X1, Matieland 7602, Stellenbosch, Republiek van Suid-Afrika. Tel.: +27 (0)21 886 9297, Sel.: +27 083 556 5155, Faks: +27 086 2734 745, E-pos: floris@sun.ac.za

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RELATIONSHIP BETWEEN TRAVEL MOTIVES AND KEY SUCCESS FACTORS OF VISITORS AT A JAZZ FESTIVAL

Karen WILLIAMS & Melville SAAYMAN
Tourism Research in Economic Environs and Society (TREES), North West University, Potchefstroom Campus, Potchefstroom, Republic of South Africa

ABSTRACT

This study set out to determine whether different target market segments have different needs as to which managerial aspects will keep them satisfied and returning to a festival. A survey was conducted at the Cape Town International Jazz Festival by means of field workers handing out 400 questionnaires to visitors. A Factor Analysis and ANOVA were carried out on the data to determine the visitors' travel motives. It was found that different target markets deem different Key Success Factors (KSFs) as important. Motives such as Socialisation, Exploration, Escape, Quest for excitement and Jazz enjoyment were identified in

the study as the main motives for visitors travelling to the Jazz Festival. Marketers can make use of these results to focus marketing resources more effectively in positioning the Cape Town International Jazz Festival in the marketplace.

Key words: Key success factors; Target markets; Market segmentation; Travel motivation; Music festival; Music events; Visitor needs.

INTRODUCTION

The purpose of this study was twofold: to determine (1) whether different target markets have different motives to visit the Cape Town International Jazz Festival (hereafter referred to as the Jazz Festival) and (2) whether these target markets deem different Key Success Factors (hereafter referred to as KSFs) to be important. The answer to this can aid the festival organisers to offer better products and services so as to encourage visitors to return to the festival. Chang (2006) and Getz (2008) state that the events tourism industry is a promising and fast growing industry and festivals such as the Jazz Festival are the reason for this rapid growth. This statement is confirmed by Leenders (2010), who indicated that thousands of music festivals are held across the world.

One such event is the Cape Town International Jazz Festival, which is held annually at the Cape Town International Convention Centre and has become the most prestigious event on the African Continent (Saayman *et al*., 2010). The Jazz Festival hosts over 40 international, as well as local jazz artists, that perform on five stages over two days. It comes as no surprise that this festival has grown immensely from its initial 14 000 visitors in 2000, to a remarkable 32 000 visitors over the past 11 years (Saayman *et al.*, 2010; Saayman & Rossouw, 2010). This festival provides the visitor with an exceptional jazz experience while contributing to the local community and economy by generating income through visitor spending as well as job creation (Saayman *et al.*, 2010; Saayman & Rossouw, 2010).

Getz (2008), Vassiliadis (2008) and Leenders (2010) emphasise that these events build community pride, enhances a region‟s image, fosters cultural development, promotes jazz, creates national identity, addresses seasonality and provides economic growth. It is apparent that this festival is an important addition to the tourism events calendar; therefore, the festival needs to sustain its market share. To achieve this, the festival organisers need to ensure that they provide visitors with a satisfactory experience so that they can return, as Saayman and Rossouw (2010) emphasise that repeat visits contribute to the viability of the event.

LITERATURE REVIEW

As a result of the rapid growth of the events tourism industry, the marketing of events such as the Jazz Festival has become extremely competitive (Leenders, 2010). Successful marketing requires event organisers to meticulously plan and evaluate the visitors‟ experience, in order to create an event that will satisfy visitor needs (Bloom, 2005) and provide them with a memorable experience so as to return. The aim of the marketing campaign should be to attract and maintain those visitors that are the most important to sustain the event. These include the jazz lovers that attend performances and spend at the festival, since these visitors will generate high revenues and, in turn, ensure that the festival

is economically sustainable (Bieger & Laesser, 2002; Laesser & Crouch, 2006).

It is imperative that financial resources be used effectively and efficiently in terms of marketing. The way to go about this is to concentrate on the right group of visitors (market) and their ever-changing needs (Laesser & Crouch, 2006). Additionally, it is important to understand what motivates visitors to attend the festival and to investigate the characteristics of homogeneous groups of visitors that will be viable for the focus of marketing strategies (Jang *et al*., 2002; Bloom, 2005; Saayman, 2006). Market segmentation is used for this purpose, since it is unrealistic to market to every individual visitor, as opposed to targeting a specific segment that will generate return visits and, in turn, sustain the event and its income (Jang *et al*., 2004; So & Morrison, 2004; Slabbert, 2006; Tkaczynski *et al*., 2009).

Market segmentation is defined as a technique to divide a large group of visitors into smaller segments that are homogeneous in nature, and thereby to understand their needs and to focus scarce marketing and financial resources on a specific segment that is most valuable to the festival, so as to not waste scarce resources on segments that are not viable (Johns & Gyimothy, 2002; Park & Yoon, 2009). Such a segment is also known as a niche market (Jayawardena, 2002). Park and Yoon (2009) further believe that segmentation allows the organisers of an event to supply products more efficiently to meet the target market‟s identified needs and this, in turn, leads to a competitive advantage (Kastenholz *et al*., 1999).

It is clear why it is stated that market segmentation is one of the most powerful strategic tools in the tourism industry (Dolnicar & Leisch, 2003). Bieger and Laesser (2002) state that there are many ways to segment a market, but motive-based segmentation has proven to be an efficient way. A motive is defined as an internal factor that arouses, directs and integrates a person‟s behaviour (Iso-Ahola, 1980). A motive can therefore be seen as the driving force behind all behaviour and should be considered as the starting point of the decision-making processes. However, the motive is based on a specific need. A need is defined as a condition or situation in which something is required or wanted (Farlex, 2012).

Crompton and McKay (1997) highlight the reasons for determining travel motives. Firstly, travel motives are the key to the design of tourism offerings, since tourists buy the expectation of the benefits that satisfy a need. Secondly, travel motives have a close relationship with satisfaction, since motives occur before the experience and satisfaction after it. Thirdly, the understanding of travel motives will provide greater clarity on the visitor/tourist decision-making process.

***TABLE 1*: PREVIOUS RESEARCH ON MUSIC FESTIVAL MOTIVES**

Author	Name of festival	Identified dimensions

Formica & Uysal (1996)	Umbria Jazz Festival, Italy	Excitement/thrill, Socialisation, Entertainment, Event novelty, Family togetherness
Schneider & Backman (1996)	Arabic cultural festival in Jordan (Jerash Festival for Culture and Arts)	Family togetherness/socialisation, Social/leisure, Festival attributes, Escape, Event excitement.
Prentice & Anderson (2003)	Edinburgh Festival, Scotland	Festival atmosphere, Socialisation, Specific and generic utilitarian activities (e.g. to see new experimental performances, enjoy plays and musicals, learn about Scottish cultural traditions).
Bowen & Daniels (2005)	Regional music festival, USA	Discovering music enjoyment
Van Zyl & Botha (2003)	Aardklop National Arts Festival, South Africa	*Push dimensions*: Family togetherness, Socialisation, Escape, Event novelty, Community pride, Self-esteem. *Pull dimensions*: Entertainment, Food and Beverages, Information and marketing, Transport.
Kruger *et al*. (2009)	Aardklop National Arts Festival, South Africa	Festival products/shows, Family togetherness, Exploration, Escape, Festival attractiveness
Kruger & Saayman (2009)	Oppikoppi Arts festival South Africa	Group togetherness, Escape, Cultural exploration, Event novelty and regression, Unexpectedness, Socialisation

The literature review revealed several studies conducted on travel motives to events, since the first motivational study conducted by Ralston and Crompton (1988). These studies have identified common factors across different festivals and events, including „escape" (Mohr *et al*., 1993; Schneider & Backman, 1996; Kruger & Saayman, 2009; Li *et al*., 2009), „family togetherness" (Formica & Murrmann, 1998; Lee *et al*., 2004; Yuan *et al*., 2005; Li *et al*., 2009), and „socialisation" (Formica & Uysal, 1996; Lee, 2000; Chang, 2006; Hixon *et al*., 2011). However, when it comes to a music event specifically, fewer studies are reported and especially those with a Jazz content. Table 1 gives an overview of some articles found in the literature. This research goes further than the ones indicated in Table 1, where it determines whether these markets (stemming from the motivation segmentation process) have different perceptions of the key success factors (KSFs) that will be of critical importance to the success of an event. This is firstly prompted by Marais (2009), who found that different markets have different key success factors influencing their experience at a wine festival and that travel

motives alone are not sufficient if event organisers want to improve services, and therefore, visitor satisfaction or to create a memorable experience. Secondly, Nicholson and Pearce (2001) suggested that the tourism research community should examine the broader characteristics of event tourism motivation and to explore issues of greater generality.

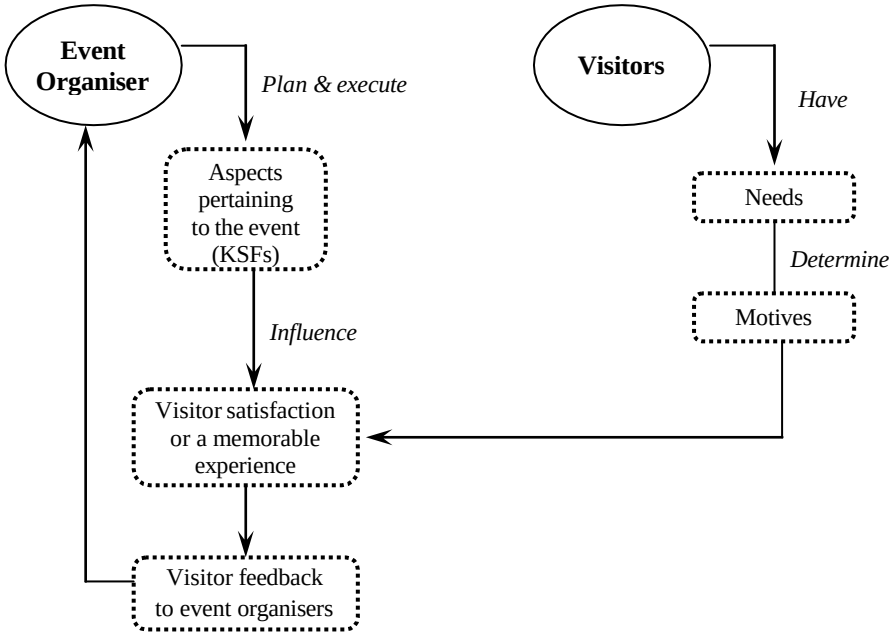

***FIGURE 1*: CONCEPTUAL FRAMEWORK INTEGRATING MOTIVES AND KSFs**

Key success factors can be defined as a strategic planning process that will assist management in focusing its efforts on areas that will satisfy the visitor and, in turn, provide the festival with a competitive advantage in the marketplace (Rockart, 1979; Brotherton & Shaw, 1996). Key success factors are, therefore, core to the success of an event. Leenders (2010) states that festivals like any organisation are faced with many issues, such as increased competition, technological changes to name but a few. In addition, their customer orientation seems to be less important and often needs to be balanced with other non-commercial providers. Lee *et al*. (2004), however, warn that festivals still have to meet the needs of visitors in order to satisfy their expectations, which remains a challenge. Figure 1 is a conceptual framework based on the literature review indicating the relationship between motives and KSFs and how they contribute to a satisfied visitor.

***TABLE 2*: PREVIOUS STUDIES CONDUCTED REGARDING KSFs**

Studies	Findings
Van der Westhuizen (2003) *KSFs imperative for developing and managing a guesthouse: Supply side analysis*	

Kruger (2006)
KSFs for conference facilities: Supply side analysis

De Witt (2006)
KSFs for managing events: Supply side analysis

Getz & Brown (2006)
KSFs for the development and marketing of wine tourism regions: Supply side analysis Marais (2009)
KSFs for visitors to the Wacky Wine Festival: Demand side analysis

- Guesthouse is located in the right surroundings
- High levels of hygiene
- Showing courtesy to guests
- Showing guests to their rooms
- Welcoming guests in a personal manner upon arrival
- Services provided meet
- Surroundings
- Determining whether the needs of guests are provided for by rendered services
- Determining whether the facilities meet the needs of the target market
- Applying a code of ethics
- Performing financial control
- Advertising the conference facility
- Recruiting the right person for the right job
- Providing sufficient lighting in conference rooms
- Providing catering services at the conference centre
- Neat and tidy restrooms
- Generating feedback from a conference
- Ensuring high levels of hygiene.
- Being able to create a positive organisational behaviour.
- Owning a liquor licence.
- Providing services that meet the needs of guests
- Availability of secure parking.
- Availability of a variety of menus.
- Multi-skilled employees.
- Availability of clear signage.
- Marketing of the venue.
- Offering unique products.
- Prefer wine destinations that offer a wide variety of cultural and outdoor attractions.

- Good quality management.
- Effective marketing.
- Good signage.
- Adequate staff at wineries.
- The affordability and variety of wines.
- Variety of entertainment.
- Comfortable wine farm facilities.

The decision to travel depends on certain needs that motivate a person to attend the event (Park & Yoon, 2009). This leads to groups of visitors (markets) travelling to the same event for similar reasons, thus creating homogeneous markets. Marais (2009) states that these visitors will all have an experience at the festival and their experience will be influenced by various KSFs, such as the quality of venues, the quality of food, security measures and the performances of artists. These factors need to be managed by the organisers for the visitors to

have a memorable and satisfactory experience (Dewar *et al*., 2001). Marais (2009) emphasises that these factors differ from one market to the next. In addition Leenders (2010) states that festivals can be explained from both a demand and supply side and emphasises the fact that research on factors contributing to the success of a festival is scant.

Based on the literature review, it became clear that research dealing with KSFs of music events have not been done to the best of the authors‟ knowledge. In the research conducted by Leenders *et al*. (2005), these researchers touched on some of the aspects, although the purpose of their research was different. This research will therefore make a contribution by filling an existing gap.

Table 2 highlighted various studies conducted on KSFs at events since several similar studies were conducted in other sectors of the tourism industry. The majority of these studies were conducted from the supply side (management perspective) and found that good signage, hygiene and effective marketing were common factors in these studies. However, the study of Marais (2009) was conducted from the demand side (visitor perspective) and showed that the most important aspect is quality management and that, although marketing and signage were seen as important, they were less important than quality management. From Table 2, it is clear that demand side results differ from those of the supply side. Furthermore, no similar research conducted at a music festival could be found in the literature.

METHOD OF RESEARCH

Quantitative research was conducted at the Jazz Festival amongst the visitors by means of a self-completion questionnaire. Based on studies by Van der Westhuizen (2003), De Witt (2006), Kruger (2006) and Marais (2009) the questionnaire used in this research was designed to determine the constructs for the KSFs. This was done in collaboration with the festival organisers to ensure that all aspects of this particular event were covered. From this process 45 constructs were identified and applied. The motivational constructs were based on research by Formica and Uysal (1996), Prentice and Anderson (2003), Bowdin and Daniels (2005) and Kruger *et al*. (2009). Through this process, 23 constructs were identified and used. The questionnaire comprised of different sections. ***Section A***, consisted of the demographic information of the visitors, such as gender, age, language, home town, occupation, group size, number of people paid for, length of stay and type of accommodation. ***Section B*** consisted of festival information, such as festival package, favourite artists, reason for visit, number of visits to the festival, other festivals visited, and number of shows attended, where information about the festival was retrieved, and whether it is important to receive information regarding the festival. ***Section C*** consisted of the motivation and evaluation of the festival and the visitor was asked to complete a Likert scale to rate the reasons for attending the festival, as well as rate the importance of several KSFs of the festival.

A total of 400 structured questionnaires were distributed by field workers between the five stages and the food courts at the Jazz Festival held over a period of two days. According to Singel (2002), for any population of 50 000 (N) the recommended sample size is 381. Given that approximately 32 000 visitors attended the Jazz Festival in 2009, 400 questionnaires were more than sufficient. Respondents were selected by using a non-probability sampling method based on a quota (number) of questionnaires per day. Two hundred questionnaires were distributed per day at several locations at the event site to minimise bias.

Microsoft© Excel© was used for data capturing and SPSS (SPSS Inc, 2007) was used

for further analysis. Results were completed in three stages. Firstly, two principal component factor analyses, using an Oblimin rotation with Kaiser Normalisation were performed. One was done to determine the KSFs and the second based on the motives, to explain the variance-covariance structure of the set of variables through a few linear combinations of these variables. The Kaiser-Meyer-Olkin measure of sampling adequacy, as well as Bartlett‟s Test of Sphericity was used to determine whether the covariance matrix was suitable for factor analysis. Kaiser‟s criterion for the extraction of all factors with eigenvalues larger than unity was used. Any item that cross-loaded on two factors with factor loadings greater than 0.25, was categorised in the factor where interpretability was best (Steyn, 2000). A reliability coefficient (Cronbach‟s alpha) was computed for each factor to estimate the internal consistency of each factor. All factors with a reliability coefficient above 0.6 were considered to have acceptable internal consistency. The average inter-item correlations were also computed as another measure of reliability. According to Clark and Watson (1995), the average inter-item correlation should lie between 0.15 and 0.55. Five factors were extracted in both cases that explained 58% and 63.5% of the total variance for motives and KSFs respectively.

Secondly, a cluster analysis, using Ward‟s method with Euclidean distances, was performed on the travel motives scores. According to Hair *et al*. (2000:594) a cluster analysis can be defined as "a multivariate interdependence technique whose primary objective is to classify objects into relatively homogeneous groups based on the set of variables considered" (Jurowski & Reich, 2000:69). Lastly, multivariate statistics were used to examine the statistically significant differences between the motivational clusters. Two-way frequency tables and Chi-square tests were conducted to profile the clusters demographically, and ANOVAs with Tukey‟s multiple comparison were conducted to investigate and determine any significant differences between the clusters concerning factor scores. This study used demographic variables (gender, home language, age occupation and province of origin), behavioural variables (length of stay, genres of shows and spending) and KSFs to examine whether statistically significant differences existed between the different groups.

RESULTS

The results will first, address the KSFs then the travel motives and thereafter, the cluster analysis. The factor analysis conducted on the 45 items explained 63.5% of the total variance and identified five KSFs namely: *Value and quality* (4.35), *Quality venues* (4.32), *Hospitality factors* (4.28), *Information dissemination* (4.27) and *Marketing and sales* (4.15) as indicated in Table 3.

***TABLE 3*: KSFs OF THE JAZZ FESTIVAL**

Motivation Factors	**Factor Loadings**	**Motivation Factors**	**Factor Loadings**
Motivation Factors	**Factor Loadings**		
Factor 1: Hospitality Factors		***Factor 2: Quality Venues***	
Adequate seating in food court	0.685	Good quality sound	0.753
Adequate safety measures	0.649	Big enough concert halls	0.709
Visible emergency personnel	0.649	Comfortable venues	0.696
Good quality food	0.649	Air conditioning	0.693

Festival programme for all ages	0.600	Visibility of stage	0.670
Affordable food	0.588	Variety national & international artists	0.630
Good quality viewing on big screen	0.573	Accessibility of festival entry points	0.591
Visible security	0.551	Good service at concert halls	0.590
Friendly personnel	0.396	Enough seats	0.384
Adequate ATM"s	0.370	Punctuality	0.352
Adequate rubbish bins	0.331	Effective technical aspects	0.333
Mean Value	**4.28**	***Mean Value***	**4.32**
Reliability Coefficient	**0.94**	***Reliability Coefficient***	**0.91**
Ave Inter-Item Correl.	**0.60**	***Ave Inter-Item Correl.***	**0.49**
Factor 3: Information Dissemination		***Factor 4: Marketing and Sales***	
		Adequate information on festival website	0.860
Effective signage on festival terrain	0.787	User friendly and accessible website	0.779
Adequate security at parking	0.742	Effective ticket sales at *Rosies*	0.678
Effective signage & directions in city	0.700	Effective marketing prior to festival	0.642
Adequate information centres	0.684	Adequate information regarding festival	0.624
Adequate parking	0.610	Prior effective ticket sales via internet	0.598
Good layout of festival terrain	0.439	Festival personnel noticeable	0.440
Accessibility for disabled	0.300	Affordable souvenirs	0.285
Mean Value	**4.27**	***Mean Value***	**4.15**
Reliability Coefficient	**0.90**	***Reliability Coefficient***	**0.90**
Ave Inter-Item Correl.	**0.56**	***Ave Inter-Item Correl.***	**0.54**
Factor 5: Value and Quality			
Good quality shows	0.671		
Affordable weekend passes	0.529		
Affordable day passes	0.517		
Clean ablution facilities	0.433		
Effective token service	0.383		
Personnel trained to handle inquiries	0.361		
Adequate ablution facilities	0.312		
Mean Value	**4.35**		
Reliability Coefficient	**0.91**		
Ave Inter-Item Correl.	**0.61**		
Total variance explained	**63.5%**		

Even though all factors scored high, *Value and quality (4.35)* was rated as the most important KSF, which include good quality shows, affordable day and weekend passes, clean and adequate ablution facilities, effective token service and personnel that are trained to handle enquiries (Table 3). *Quality venues (4.32)* was rated the second highest and included aspects, such as good quality sound, big enough and comfortable concert halls and good technical aspects. This was followed by *Hospitality factors (4.28), Information dissemination (4.27)* and *Marketing and sales (4.15)*, which were rated as the least important. From the factor

analysis on motivational constructs, 5 main motives were identified and labelled according to similar characteristics as found in the literature review.

***TABLE 4*: TRAVEL MOTIVES OF VISITORS TO THE JAZZ FESTIVAL**

Motivation construct	Factor Loadings	Mean Value	Reliability Coefficient	Ave. Inter-Item Correl.
Factor 1: Socialisation		3.78	0.84	0.40
Buy CDs/DVDs	0.73			

Meet people	0.57			
Meet jazz artists	0.56			
Learn	0.51			
Socialise with jazz lovers	0.45			
Annual commitment	0.45			
Be part of event	0.33			
Something out of the ordinary	0.29			
Factor 2: Exploration		3.46	0.73	0.40
Visit Cape Town	0.83			
Amateur musician	0.66			
Explore new destination	0.47			
Value for money	0.33			
Factor 3: Escape		3.97	0.60	0.32
Relax from daily tension	0.39			
Escape	0.25			
To break away	0.25			
Get refreshed	0.29			
Factor 4: Quest for excitement		3.98	0.61	0.35
Do exciting things	0.633			
Share experiences	0.544			
Learn new things	0.302			
Factor 5: Jazz enjoyment		4.35	0.74	0.42
Have fun	0.83			
Listen to jazz	0.60			
Enjoy jazz	0.59			
Spend time with friends	0.41			
Total variance explained	**58%**			

The factor scores were calculated as the average of all items contributing to a specific factor so that it can be interpreted on the original 5-point Likert scale with „1“ being not at all important and „5“ being extremely important. The factor that scored the highest was *Jazz enjoyment* (4.35), and included aspects such as having fun, enjoying and listening to jazz and spending time with friends. *Quest for excitement* (3.98) was rated as the second highest factor and included doing exciting things, learning new things and sharing experiences (Table 4). The lowest factor scored with a mean value of 3.46 was *Exploration* and consisted of items such as visiting Cape Town, exploring a new destination, being an amateur musician and experiencing value for money. In order to understand the various motives from different market segments, a cluster analysis was conducted.

The Cluster analysis based on all cases in the data was performed on the 5 motives indicated above. A hierarchical analysis using Ward‟s method of Euclidean distances was applied to determine the structure of the clusters based on the motives factors. Two- and three-cluster solutions were examined, and the three-cluster solution was selected as the most discriminatory (Figure 2). Next a set of multivariate statistics was used to identify the three clusters, as well as to indicate that significant differences existing between them ($p<0.05$).

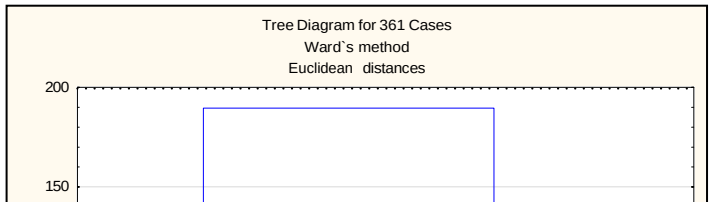

***FIGURE 2*: WARD'S CLUSTER ANALYSIS**

Identification of segmented clusters

Results from the ANOVAs on the five motivational factors indicated statistically significant differences, as well as the fact that all 5 factors contributed to differentiating between the 3 motivational clusters. In addition, Tukey‟s post hoc multiple comparisons were employed to explore these differences between clusters with regard to each factor. Table 5 indicates differences in means between the three clusters and reveals the importance of each of the factors for festival travel for the members of each cluster.

***TABLE 5*: CLUSTERS AND MOTIVES**

Motives	Cluster 1 Escapists (n=94)	Cluster 2 Culture seekers (n=229)	Cluster 3 Jazz lovers (n=38)	F-Ratio	p
Socialisation	2.77[a]	3.94[b]	4.96[c]	238.254	<0.05
Exploration	2.17[a]	3.69[b]	4.95[c]	287.020	<0.05
Escape	3.21[a]	4.05[b]	4.95[c]	65.631	<0.05
Quest for excitement	3.17[a]	4.09[b]	4.97[c]	123.675	<0.05
Jazz enjoyment	3.80[a]	4.43[b]	4.97[c]	72.419	<0.05

Cluster 1 (94 respondents), had the lowest mean values for all 5 travel motivations (Socialisation, 2.77; Exploration, 2.17; Escape, 3.21; Quest for excitement, 3.17; Jazz enjoyment, 3.80). Cluster 1 was thus labelled *Escapists*, as they seem to be the accompanying persons to the Jazz Festival. Cluster 2 (229 respondents), was labelled *Culture seekers*, as their interest was in new and exciting jazz experiences. Cluster 3 (38 respondents), had the highest mean scores for all the factors among the 3 cluster groups and was labelled *Jazz lovers* as they visited the festival to get the ultimate jazz experience and all aspects pertaining to the festival are important to this cluster. Jazz lovers are the visitors that live and breathe jazz.

Respondents were asked to indicate how important they considered each item on the scale (1=not at all important to 5=extremely important). Tukey‟s multiple comparisons indicate that statistically significant differences exist among the clusters with different superscripts. For example, in terms of Socialisation, differences were found between Cluster 1 (superscript a) and all the other clusters. Cluster 2 (superscript b) differed from all the other clusters, and Cluster 3 (superscript c) also differed from all the other clusters.

Table 5 also indicates that all 3 clusters placed higher importance on Escape, Quest for excitement and Jazz enjoyment than on Socialisation and Exploration. The cluster analysis identified the most significant market segment as the „Jazz lovers‟ (Cluster 3). The „Jazz lovers‟ are characterised by having the highest mean scores across the 5 motivational factors. The total number of respondents (38), was not high in this Cluster, suggesting that the Jazz Festival should concentrate on this market so as to keep them returning to the festival and to grow this segment to a bigger portion of the total market. However, it needs to be taken into consideration that it is not economically viable to advertise and concentrate on this market only. Therefore, the „Culture seekers‟ that were identified as the second most viable cluster to the festival and had the highest total of respondents, should also be targeted to keep them satisfied and returning to the festival. This, in turn, will lead to the festival‟s sustainability. Recognising that the „Escapists‟ can be seen as accompanying persons, it is clear that if Cluster 2 („Culture seekers‟) and Cluster 3 („Jazz lovers‟) are the focus, then the „Escapists‟ should grow accordingly.

Characteristics and the KSFs of visitors

ANOVAs and Tukey‟s post hoc multiple comparisons were conducted to determine the differences in other characteristics and the KSFs of visitors. Table 6 shows that there were statistically significant differences between the *Escapists, Culture seekers* and *Jazz lovers* based on the number of people paid for and the KSFs that each cluster deemed to be important for them at the festival.

***TABLE 6*: DIFFERENCES IN CHARACTERISTICS AND KSFs OF CLUSTERS**

Characteristics	Cluster 1 *Escapists* (n=94)	Cluster 2 *Culture seekers* (n=229)	Cluster 3 *Jazz Lovers* (n=38)	F-Ratio	p
Age	35^{a}	37^{b}	35^{a}	0.607	0.545
Years attended	3^{a}	3^{a}	4^{b}	1.650	0.194
Length of stay					
Days	2^{a}	2^{a}	2^{a}	0.978	0.377
Nights	15^{a}	4^{b}	3^{c}	2.496	0.086
Group size	4^{a}	4^{a}	5^{b}	0.791	0.454
People paid for	2^{a}	2^{a}	2^{a}	3.249	0.040*
Number of shows	6^{a}	6^{a}	7^{b}	0.474	0.623
Key success factors					
Hospitality factors	3.97^{a}	4.29^{b}	4.85^{c}	19.695	<0.05
Quality venues	3.95^{a}	4.35^{b}	4.76^{c}	24.113	<0.05
Information	3.90^{a}	4.32^{b}	4.77^{c}	19.779	<0.05

Dissemination	3.74[a]	4.19[b]	4.81[c]	33.652	<0.05
Marketing and sales value and quality	4.03[a]	4.40[b]	4.76[c]	15.444	<0.05

* Statistically significant difference= p≤0.05

Note: Tukey‟s multiple comparisons indicate that statistically significant differences exist among the clusters with different superscripts**.** For example, in terms of the KSFs, differences were found between Cluster 1 (superscript a) and all the other Clusters. Cluster 2 (superscript b) differed from all other clusters and Cluster 3 (superscript c) differed from all the other Clusters.

The following are the results based on Table 6:

Age: „Culture seekers‟ (Cluster 2) differ from „Escapists‟ (Cluster 1) and „Jazz lovers‟ (Cluster 3). „Culture seekers‟ are 37 years of age, whereas „Escapists‟ and „Jazz lovers‟ are younger.

Years attended: The „Escapists‟ (Cluster 1) and „Culture seekers‟ (Cluster 2) have attended the Jazz Festival for 3 years, whereas the „Jazz lovers‟ (Cluster 3) have attended for 4 years.

Length of stay: All 3 clusters stay an average of 2 days at the Jazz Festival, which means that they stay for the entire 2-day festival.

Group size: The „Escapists‟ (Cluster 1) and „Culture seekers‟ (Cluster 2) travel in groups of 4, whereas the „Jazz lovers‟ (Cluster 3) travel in groups of 5.

People paid for: All 3 clusters pay for an average of 2 people at the Jazz Festival.

Number of shows: „Escapists‟ (Cluster 1) and „Culture seekers‟ (Cluster 2) see an average of 6 shows at the Jazz Festival, whereas the „Jazz lovers‟ (Cluster 3) watch 7.

Key success factors: Regarding the KSFs, there were statistically significant differences based on the 5 factors.

- *Hospitality factors* (p<0.05): „Jazz lovers‟ differed from „Culture seekers‟ and „Escapists‟. Hospitality factors were more important to the „Jazz lovers‟ than to the „Escapists‟ and „Culture seekers‟.
- *Quality venues* (p<0.05): „Jazz lovers‟ considered Quality venues more important than „Culture seekers‟ and „Escapists‟.
- *Information dissemination* (p<0.05): The importance of information regarding the Jazz Festival was thought to be more important to the „Jazz lovers‟ than to the „Escapists‟ and
  „Culture seekers‟.
- *Marketing and sales* (p<0.05): „Jazz lovers‟ considered Marketing and sales more important, followed by „Culture seekers‟.
- *Value and quality* (p<0.05): Value and quality are factors that „Jazz lovers‟ consider more important than „Culture seekers‟ and „Escapists‟.

It is clear that all the KSFs are of the utmost importance to the „Jazz lovers‟, followed by the

„Culture seekers". The „Escapists" deemed the KSFs as the least important compared to the „Jazz lovers" and „Culture seekers", which once again confirms that they can be seen as accompanying persons to the Jazz Festival.

Demographic profile

Two-way frequency and Chi-square tests were conducted to provide a complete demographic profile and show whether significant demographic differences existed between the three clusters.

***TABLE 7*: DEMOGRAPHIC PROFILE OF CLUSTERS**

Characteristics	**Cluster 1** *Escapists* (n=94)	**Cluster 2** *Culture seekers* (n=229)	**Cluster 3** *Jazz lovers* (n=38)	**Chi-square value**	**df**	**p**	**Phi-value**
Gender				2.597	2	0.273	0.085
Male	55%	46%	45%				
Female	45%	54%	55%				
Home Language				4.781	10	0.905	0.116
English	67%	65%	63%				
Afrikaans	8%	6%	8%				
Other	25%	29%	29%				
Province				20.645	16	0.193	0.241
Western Cape	69%	65%	74%				
Gauteng	9%	15%	13%				
Eastern Cape	4%	7%	3%				
Free State	1%	4%	5%				
Other	17%	9%	5%				

***TABLE 7*: DEMOGRAPHIC PROFILE OF CLUSTERS (*cont.*)**

Characteristics	**Cluster 1** *Escapists* (n=94)	**Cluster 2** *Culture seekers* (n=229)	**Cluster 3** *Jazz lovers* (n=38)	**Chi-square value**	**df**	**p**	**Phi-value**
Occupation				37.793	22	0.019*	0.328
Professional	21%	29%	19%				
Management	12%	16%	17%				
Self-employed	16%	13%	8%				
Technical	9%	3%	0%				
Sales	3%	2%	11%				
Administrative	5%	8%	14%				
Civil Service	0%	1%	6%				
Education	7%	5%	3%				
Pensioner	2%	2%	6%				
Student	23%	14%	8%				
Artist/DJ	1%	1%	3%				
Other	4%	6%	5%				

Accommodation	***Yes***	***No***	***Yes***	***No***	***Yes***	***No***				
Local resident	64%	36%	55%	45%	47%	53%	3.670	2	0.160	0.101
Family/friends	17%	83%	18%	82%	13%	87%	0.518	2	0.772	0.038*
Guesthouse/B&B	5%	95%	10%	90%	10%	90%	1.764	2	0.414	0.070
Hotels	12%	88%	11%	89%	13%	87%	0.178	2	0.915	0.022*
Camping	0%	100%	2%	98%	0%	100%	2.332	2	0.312	0.080
Rent full house	1%	99%	3%	97%	3%	97%	0.779	2	0.677	0.046*
Hostels	1%	99%	1%	99%	0%	100%	0.513	2	0.774	0.038*
Day visitor	1%	99%	4%	96%	5%	95%	2.038	2	0.361	0.075
Package	***Yes***	***No***	***Yes***	***No***	***Yes***	***No***				
Weekend pass	45%	55%	57%	43%	60%	40%	4.400		0.111	0.113
Day pass	44%	56%	38%	62%	31%	69%	1.862		0.394	0.074
Travel Package	4%	96%	3%	97%	0%	100%	1.570		0.456	0.068
Main reason for attendance?							10.292	6	0.113	1.173
Yes	17%		29%		22%					
No	28%		23%		11%					
Local	55%		48%		67%					
Visit initiated by:	***Yes***	***No***	***Yes***	***No***	***Yes***	***No***				
Self	54%	46%	43%	57%	32%	68%	6.309	2	0.430	0.132
Friends	21%	79%	30%	70%	29%	71%	2.642	2	0.267	0.086
Media	3%	97%	7%	93%	3%	97%	2.965	2	0.227	0.091
Spouse	6%	94%	6%	94%	18%	82%	7.355	2	0.025*	0.143
Family	16%	84%	14%	86%	21%	79%	1.316	2	0.518	0.060
Work	7%	93%	4%	96%	3%	97%	1.831	2	0.400	0.071
Attend again							44.383	4	0.000*	0.357
Yes	73%		96%		97%					
No	3%		0%		0%					
Perhaps	24%		4%		3%					

***TABLE 7*: DEMOGRAPHIC PROFILE OF CLUSTERS (*cont.*)**

Characteristics	**Cluster 1** *Escapists* (n=94)		**Cluster 2** *Culture seekers* (n=229)		**Cluster 3** *Jazz lovers* (n=38)		**Chi-square value**	**df**	**p**	**Phi-value**
Obtained info from	***Yes***	***No***	***Yes***	***No***	***Yes***	***No***				
Newspapers	38%	62%	45%	55%	37%	63%	2.308	2	0.679	0.080
Festival guide	18%	82%	31%	69%	29%	71%	5.412	2	0.067	0.123
Website	56%	44%	46%	54%	42%	58%	3.504	2	0.173	0.099
Source of information	***Yes***	***No***	***Yes***	***No***	***Yes***	***No***				
TV	25%	75%	28%	72%	37%	63%	2.053	2	0.358	0.076
Radio	32%	68%	38%	62%	58%	42%	7.826	2	0.020*	0.147
Festival website	22%	78%	21%	79%	32%	68%	2.267	2	0.322	0.079
Newspaper	27%	73%	25%	75%	26%	74%	0.102	2	0.950	0.017*

Word of mouth	33%	67%	41%	59%	37%	63%	1.758	2	0.415	0.070
Billboards/Posters	27%	73%	28%	72%	21%	79%	0.823	2	0.663	0.048*
Email	15%	85%	15%	85%	5%	95%	2.643	2	0.267	0.086

There were statistically significant differences between some of the aspects that were measured (Table 7). These aspects include *Accommodation* (Family and friends, Hotels, Renting full houses and Hostels) and *Types of marketing* (Newspaper and Billboards and Posters). It is clear that there were more differences regarding the behavioural aspects than demographic and motivational aspects as can be seen in Table 7 above. Results from this research confirm, but also contradict previous research.

FINDINGS AND IMPLICATIONS

The first implication reveals that the motives for attending the Jazz Festival differ from event to event even though events might be similar (Formica & Uysal, 1996; Bowen & Daniels, 2005; Kruger & Saayman, 2009; Hixson *et al*., 2011). Five motives were identified for attending the Jazz Festival. These were *Socialisation, Escape, Exploration, Quest for excitement* and *Jazz enjoyment*. Motives such as *escape, family togetherness, socialisation* and *festival attractiveness* are not also common motives in the event literature in general but also in this type of event (Kruger & Saayman, 2009; Li *et al*., 2009; Hixson *et al*., 2011), with one exception that *Family togetherness* was not identified as a key motive in this study even if it is generally seen as a common motive. *Quest for excitement* has not been found in the literature concerning music festivals. It is the first time that this motive has been identified. The implication of this finding is that event organisers can use these motives to focus their marketing campaign in order to attract more visitors.

Secondly, the research revealed three clusters of Jazz festival attendees. These were labelled *Escapists* that can be seen as accompanying persons; *Culture seekers* that had the second highest mean values for all the motivational factors and are the largest sample of respondents; and lastly, the *Jazz lovers*, who had the highest mean values for all the motivational factors, but had the smallest sample of respondents. „Jazz lovers" (Cluster 3) and „Culture seekers" (Cluster 2) are the Jazz Festival"s most important and viable markets and the two that should be considered as the primary markets. Event organisers should focus their resources on these two markets. It seems that if these markets grow, then the „Escapists", as accompanying persons, will grow accordingly.

Lastly, the research showed that the different clusters have different KSFs influencing visitors" experience. In addition, it was also found that KSFs not only differ from one event or sector to the next but also between demand and supply side. These findings confirm Marais"s (2009) notion that different markets have different KSFs. Based on the conceptual framework as portrayed in Figure 1, one could say that the identification of motives alone is not good enough if the intention is to grow and offer better services, experiences resulting in a successful event. The „Jazz lovers" considered *Hospitality factors* (adequate safety, good quality and affordable food, festival programme for all ages, good quality viewing on big screen, friendly personnel, adequate rubbish bins) to be most important, followed by *Marketing and sales, Information dissemination, Quality venues* and *Value and quality*. Furthermore, „Culture seekers" deemed „Value and quality" (good quality shows,

affordable passes, clean and adequate ablution facilities, effective token service, trained personnel) to be the most important, followed by „Quality venues", „Information dissemination", „Hospitality factors" and „Marketing and sales". Organisers should concentrate resources on these needs and wants to satisfy these markets so that these visitors will return the following year. Compared to the study conducted by Marais (2009) from a demand side, similarities were found, such as visitors to both festivals wanted affordable products, adequate number and trained staff to handle enquiries, effective security measures and adequate and clean ablution facilities. However, most of the KSFs differed. This implies that one cannot apply results from one event to another. It also implies that managers (supply side) should take note of what visitors (demand side) regard as important. In the words of Lee *et al*. (2004:586) "it is important in order to satisfy visitors" needs". Event organisers can use the results from this study to create a memorable experience.

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was firstly to determine whether different target markets have different motives for visiting the Cape Town International Jazz Festival, and secondly if these target markets deem different KSFs to be important. The findings revealed that different markets do have different travel motives and these motives confirmed but also contradicted research conducted at similar events. These motives were *Socialisation, Escape, Exploration, Quest for excitement* and *Jazz enjoyment*. „Quest for excitement" was not found in the literature reviewed. In addition, three markets were identified based on the travel motives, namely „Escapists", „Culture seekers" and „Jazz lovers". These three markets also regard different KSFs to be important when visiting the Jazz Festival. The „Culture seekers" consider good „Value and quality venues" to be imperative, whereas the „Jazz lovers" reckon that
„Hospitality factors" and good „Marketing and sales" are most important.

Findings from this study contribute to the body of knowledge firstly in the three identified segments based on travel motives, which contributes to the limited research conducted on travel motives of jazz festival attendees. It also gives a greater understanding of why visitors travel to a music festival and what they believe to be important. Secondly, this research also contributes to the literature based on KSFs, since only a few studies have been conducted from a demand side. In addition, this research describes the links between motives and KSFs, which was done for the first time at a jazz festival. This research brings to the fore that travel motives alone are not good enough if one wants to improve services and contribute to visitors" memorable experience.

Thirdly, the results from this research can be incorporated into events curricula to make students aware of the fact that different KSFs are different for visitors to different events. Lastly, it is recommended that similar studies be conducted at other music festivals in South Africa and abroad, so as to be able to make comparisons resulting in a better understanding of what event organisers need to do to satisfy their needs.

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Ms. Karen Williams: Tourism Research in Economic Environs and Society (TREES), North West University, Potchefstroom campus, Private Bag X6001, Potchefstroom 2520, Republic of South Africa. Tel: (018) 299 1810, Fax: (018) 299 4140, E-mail: karen.williams004@gmail.com

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COMPARISON OF PHYSICAL FITNESS OUTCOMES OF YOUNG SOUTH AFRICAN MILITARY RECRUITS FOLLOWING DIFFERENT PHYSICAL TRAINING PROGRAMS DURING BASIC MILITARY TRAINING

Paola S. WOOD & Pieter E. KRÜGER
Department of Biokinetics, Sport and Leisure Sciences, University of Pretoria, Pretoria, Republic of South Africa

ABSTRACT

Physical training (PT) is an integral part of developing operational fitness. The objective of the study was to compare the physical fitness outcomes of two groups of young South African military recruits completing 12 weeks of Basic Military Training (BMT) who followed different PT programs. A historical control group (NCPG: female n=115, male n=73) that followed a traditional PT program and an experimental group (CPG: female n=85, male n=100) that followed a new cyclic-progressive PT program participated. The standardised PT test was taken at the beginning, the fifth week and the end of the BMT period. The changes in the fitness components evaluated by the South African National Defence Force (SANDF) standardised PT test were compared. Although the new cyclic-progressive PT

program elicited more change ($p<0.05$) in the fitness parameters measured, it only yielded superior performance at the final measurement in the men's push-ups ($p=0.0001$). This may be attributed to the relatively greater amount of upper body exercises performed by the CPG and by the additional resistance offered by pole PT. The new cyclic-progressive PT program has been mandated for all BMT units across the SANDF.

Key words: Basic military training, Operational fitness, Fitness components, Cyclic-progressive

INTRODUCTION

Physical Training (PT) forms an integral part of the physical preparation and conditioning of military personnel. Military historians have repeatedly emphasised the importance of a high level of physical capability as necessary for the occupational tasks that recruits are required to perform (McGaig & Gooderson, 1986; Nye, 1986; Dubik & Fullerton, 1987; Knapik *et al.*, 2005; Dyrstad *et al.*, 2006). New recruits, making the transition from civilian to South African military life, undergo a period of initial BMT to equip them with the required optimum physical capability and skills training needed to execute their tasks effectively (Gordon *et al.*, 1986; Jordaan & Schwellnus, 1994; Knapik *et al.*, 2005; Shaffer & Uhl, 2006). During the BMT periods, recruits participate in basic military lessons, including formal PT, which consists of four 40-minute compulsory PT periods per week.

All instructors presenting BMT followed a standardised PT program in order to achieve the required results within the prescribed time (Department of Defence, 2000). As physical

fitness levels have been reported to have declined in recent decades in both the male and female population, the fitness outcomes of the BMT recruits need to be continuously monitored to ensure that the PT program is achieving the desired effects (Gordon-Larsen *et al.*, 2000; Knapik *et al.*, 2003; Knapik *et al.*, 2004; Knapik *et al.*, 2005; Dyrstad *et al.*, 2006). Research has indicated that the body improves its capacity to exercise when the PT systematically stresses the body causing the body to adapt to the stress of physical effort. If the stress is not sufficient to overload the body, then no adaptation occurs (Braith & Stewart, 2006).

PURPOSE OF STUDY

Progressive training has been shown to be beneficial and is easily attained when progressive overload, specifically, and training variation are included in the program (Kraemer *et al.*, 2002). A new cyclic-progressive PT program for BMT in the South African military was developed. It incorporated weekly progression and resistance training in the form of pole PT. The aim of the study was to determine the effectiveness of a new cyclic-progressive PT program during 12 weeks of BMT by comparing the changes in the recruits' muscle endurance, aerobic and anaerobic fitness evaluated by the standardised PT test battery (Department of Defence, 2000).

METHODOLOGY

Experimental design

The study design was quasi-experimental, comparing two cohorts. The non-cyclic-progressive group (NCPG) comprised recruits who followed the non-cyclic-progressive program and completed their BMT in 2005; the cyclic-progressive group (CPG) completed their BMT in the same corps and unit in 2006. A non-probability sampling method with a sample of convenience was used in this study (Kinnear & Taylor, 1996).

Subjects

Ethical approval was obtained from the South African Defence Force Ethics Committee (Ethical clearance number SG/R&D/2-Jun-06/ 083), as well as the Ethics Committee of the Medical Faculty of the University of Pretoria (Project number 57/2006) to conduct the study. Their ethical guidelines were followed throughout the study. Participants were volunteers from the South African Health and Medical Services BMT recruits. The NCPG and CPG consisted of 73 and 100 male recruits and 115 and 85 female recruits, respectively. No differences existed between the initial body mass, height and BMI of the two groups as outlined in Table 1. After an informational session covering all aspects of the study methodology, participants were asked to read and sign an informed consent form. All participants had passed a medical entry examination executed by a medical officer to ensure that they were free of any disorder that would contra-indicate their attendance of BMT; this included a negative serum pregnancy test.

Procedure

All the participants from the CPG and NCPG were tested using the Standardised PT test battery within 4 days of reporting for BMT, before the commencement of the normal unit PT program, 5 weeks into the BMT course, and again in the last week of the 12-week period.

Physical training programs

A standardised BMT program was followed. The main aim of BMT was to ensure a combat- ready recruit at the end of the 12-week period. Activities included drill, regimental aspects, compliments and saluting, general military aspects, musketry, shooting, signal training, mine awareness, map reading, buddy aid, field craft, water orientation, parade rehearsal and PT. Both groups, except for a different PT program, followed the same BMT program. Both cohorts completed 48 periods of PT consisting of 40 minutes each over the 12-week period (Department of Defence, 2000).

***TABLE 1*: COMPARISONS OF INITIAL PHYSICAL CHARACTERISTICS OF CONTROL GROUP (NCPG) AND EXPERIMENTAL GROUP (CPG)**

Physical characteristic	Group	Male recruits			Female recruits		
		Mean	SD	p*	Mean	SD	p*
Age (y)	NCPG	20.5	3.4	0.98	19.9	3.1	0.94
	CPG	20.2	3.3		20.0	3.2	

Height (cm)	NCPG	172.2	6.0		160.1	5.3	
	CPG	171.4	5.9	0.97	159.3	5.5	0.95
Mass (kg)	NCPG	62.3	6.7		59.1	8.7	
	CPG	61.8	6.9	0.85	60.2	9.0	0.92
BMI[#] ($kg.m^{-2}$)	NCPG	21.1	2.4		22.8	2.8	
	CPG	21.4	2.2	0.95	22.4	2.5	0.93

* p-value compares the NCPG and CPG in independent sample t-test
[#] BMI: Body Mass Index

The aim of both programs was to ensure operational fitness. This was achieved through exercises aimed at developing the basic fitness components, namely cardio-respiratory endurance and muscular endurance (Dubik & Fullerton, 1987). All PT periods had a similar lesson plan, namely warm-up, muscle endurance and/or aerobic component and cool down (stretching). The difference in the programs lay primarily in the time allocated to each component, the progression within each exercise and the inclusion of muscle endurance exercises based on resistance offered by own body weight (NCPG) only and progressing to exercises with additional resistance offered by the use of solid timber wooden poles (≈20kg, 2.1m in length by 25cm in diameter) (Table 2) (Department of Defence, 2000). The latter was only included in the program followed by the CPG from the fifth week, which provided a cost-effective and manageable method of muscle endurance training, based on the principle of free-weight training (Photograph 1) (Daniels *et al*. 1979; Jones *et al.*, 1993; Heyward, 2002; Knapik *et al.*, 2005). Due to the size and weight of the poles all exercises were executed in pairs, thus distributing the weight of the wooden pole between two recruits.

Although all attempts were made to ensure that recruits applied equal effort when using the pole this could not be ensured.

***PHOTOGRAPH 1*: EXAMPLE OF AN EXERCISE (SQUAT) PERFORMED USING SOLID TIMBER WOODEN POLES**

(POLE PT)

The CPG completed 45% more abdominal and 39% more upper body muscle endurance exercises than the NCPG did. Additionally, 46% more jogging was completed by the CPG. The program followed by the NCPG included 51% more time allocated to warm-up activities and minor games. Both groups completed similar amounts of running interval training (Table 2).

***TABLE 2*: PHYSICAL TRAINING PROGRAM OF THE NCPG AND CPG**

PT program component	Resistance	NCPG-PT	CPG-PT
Warm-up (minutes)	None	630	322
Upper body muscle endurance exercises (number)	BW (Body Weight)	51*	28**
	BW + 20kg wooden poles	0	64***
Abdominal body muscle endurance exercises (number)	BW (Body Weight)	56*	28**
	BW + 20kg wooden poles	0	64***
Jogging (minutes)	None	510	950
Interval training (minutes)	None	200	213

* From week 1 completed 3 sets of 10-12 repetitions of exercises performed by muscle groups in this body region

** From weeks 1 to 2 completed 2 sets of 10-12 repetitions progressing to 3 sets of 10-12 repetitions in week 3-4 of exercises performed by muscle groups in this body region

*** From weeks 5 to 12 completed all exercises with 20kg wooden poles in pairs performed by muscle groups in this body region starting with 2 sets of 10-12 repetitions progressing to 3 sets of 10-15 repetitions

NOTE: *Further details available in Dept. of Defence Policy on physical training and Department of Defence Instruction*

Whilst the NCPG, PT program was characterised by very little progression, the PT followed by the CPG had a progressive build-up, from walking to jogging, as the cardiovascular activity prescribed (Scully & Besterman, 1982; Popovich *et al.*, 2000), as well as a 10% weekly progression in frequency and intensity of the initial training events (Heir & Eide, 1997; Kaufmann *et al.*, 2000; Heyward, 2002; Knapik *et al.*, 2003; Rosendal *et al.*, 2003; Armstrong *et al.*, 2004).

Measurements

The fitness components evaluated were aerobic fitness via the 2.4km-run and 4km-walk, muscle endurance using the sit-up and push-up test and anaerobic fitness via the shuttle-run test. The *2.4km-run test* was executed as the first component of the standard fitness test. The test was conducted over a distance of 2.4km on a flat surface. The first half of the distance (1.2km) was run to a turning point, and the second half was run over the same route, back to the starting point. The time taken to complete the distance was timed and recorded. Following a maximum rest period of 15 minutes, but not less than 10 minutes, the *sit-up* and *push-up* tests were executed. The total number performed for each test in 2 minutes was recorded, followed by the *shuttle-run test*. The latter entailed running a distance of 22m, 10 times without any breaks. The last component was the *4km-walk* test, which was executed on a flat, circular route. No running or jogging was allowed. The time taken to complete the shuttle-run test and 4km-walk was timed and recorded. A rest period of 2 minutes was given between these components (Department of Defence, 2000).

Points are allocated to each BMT recruit according to their performance level (time measured and completed number of repetitions) per component. A BMT recruit passes a component if 600 points are achieved. Recruits under the age of 34 year pass the battery test if they achieve a minimum of 3 000 points, the sum total of points achieved for all components (Department of Defence, 2000).

Statistical analyses

Data was analysed by means of the Statistical Product and Service Solutions package (SPSS 11.5 for Windows, SPSS Inc., Chicago, IL, USA). On completion of the BMT period, 7 participants (3 males, 4 females) from the NCPG (N= 181; 70 male, 111 female) and 2 participants (2 females) from the CPG (N= 183; 100 male, 83 female) dropped out of the study. Data was only analysed for cases where complete information was available. The mean and standard deviations were used to describe the results. Student's t-tests for independent samples were used to determine whether statistically significant differences ($p<0.05$) existed between the CPG and NCPG for all fitness measurements (Hair *et al*., 1998). Multivariate analysis of co-variance confirmed whether statistically reliable mean differences amongst groups existed after adjusting the newly created dependant variables for differences on one or more covariates (Hair *et al.,* 1998). The Leverne's test and Box's test were used to assess error variance and equality of covariance respectively.

When the data was analysed for females and males separately, the base size dropped to under 70 cases per measurement. Thus, non-parametric statistics were used to analyse changes within male and female groups over time. Chi-square analysis assessed the relationship between the group membership (CPG vs. NCPG) and the pass or fail rates of the group on

total fitness test scores. The Friedman's rank test for *k* correlated samples determined whether statistically significant differences existed between the measurements obtained during the pre-test and two consecutive post-tests during the fitness tests. Effect size (ES) was calculated to assess practical significance with Cohen's (1988) criteria classifying effects as small (0.2- 0.3), moderate (0.31-0.5) or large (>0.5). The precision of these estimates was indicated by 95% confidence limits. Kendall's Coefficient of concordance assessed agreement of the changes seen within the groups, with Kendall's *W* ranging from 0 (no agreement) to 1 (complete agreement).

RESULTS

The proportion of female recruits in the NCPG was 61.3%, and that of the CPG was 45.4%, whilst the proportion of male recruits was 38.7% and 54.6% in the NCPG and CPG, respectively. Table 3 and Table 4 show the initial, mid and final Standardised Fitness Test scores of the male and female NCPG and CPG respectively, the significant changes, as well as the absolute mean difference between the groups across the 12-week BMT period as analysed by Friedman's test.

In the *initial* fitness test both the male and female recruits in the CPG took significantly longer to complete the 2.4km-run (males and females: p=0.0001; ES=1.12), whilst a large

significant difference in the 4km-walk time was only evident in the female recruits (p=0.0001; ES=0.64). Both the male and female recruits of the CPG completed significantly fewer push-ups (males and females: p=0.0001; ES=0.5 & 0.62, respectively) and sit-ups (males: p=0.0001; ES=0.64; females: p=0.002; ES=0.33), and took significantly longer to complete the shuttle-run test (males and females: p=0.0001; ES=0.64 & 0.48, respectively) at the initial fitness test.

In the *mid* fitness test no significant and small to moderate practical differences were evident between the females of the two groups for all fitness components. The CPG showed a mean 18% and 11% improvement, in their 2.4km and 4km times, respectively as well as 76% improvement in their push-up performance and a 99% and 9% improvement in their sit-up and shuttle run tests. The CPG's walked the 4km moderately faster (p=0.0001; ES=-0.39), completed moderately more sit-ups (p=0.006; ES=0.31) and push-ups (p=0.001; ES=0.37), but took significantly less time to complete the 2.4km-run (p=0.03; ES=0.25) and the shuttle runs (p=0.22; ES=-0.14), although the latter was statistically non-significant and the effect small.

With the mid fitness test as the dependant variable the multivariate analysis of covariance for both groups showed no significant difference in the covariance matrices. The error variance was equal across groups in all fitness components. Group membership was found to have a significant effect (p=0.0001) on all the fitness test components, and the CPG group membership was also associated with an increase in the number of push-ups and sit-ups performed and lowered shuttle-run, 2.4km-run and 4km-walk times. This confirmed improved performance by the CPG.

By the *final* fitness test there were no statistically significant difference between the male recruits of the two groups in the 2.4km-run time (p=0.17; ES=0.17) and the 4km-walk time

(p=0.17; ES=0.16). During the final assessment, the NCPG performed moderately significantly more sit-ups (p=0.0001; ES=-0.34) and took significantly less time to complete the shuttle-run test (p=0.0001; ES=0.93) than the CPG, whilst the men in the CPG completed moderately more push-ups (p=0.0001; ES=0.41) than the NCPG. A moderately small difference between the female recruits 2.4km-run (p=0.001; ES=0.36) highlights the decline in the CPG's performance in this variable. Similarly the female recruits in the NCPG performed significantly more sit-ups (p=0.03; ES=0.21) and ran the shuttle runs faster (p=0.0001, ES=0.54) than the CPG, whilst no difference (p=0.13; ES=-0.16) existed in the push-ups performed by the end of BMT.

With the final fitness test as the dependant variable, the multivariate analysis of covariance for the male and female group showed no significant difference in the covariance matrices, and the error variance was equal across groups in all fitness components. Group membership was found to have no significant effect on push-ups and 4km-walk measurements. However, it did have an effect on the sit-ups, shuttle-run and 2.4km-run measurement. CPG group membership was associated with a decrease in the number of sit-ups performed and an increase in shuttle-run times, confirming poorer performance as indicated in the t-test for the male recruits. The CPG was also associated with slower 2.4km-run times as supported by the t-test for the female recruits.

Mean changes *within* the groups are presented in Table 3 and Table 4, while Table 5 indicates that within the CPG, both the male (W=0.68; p=0.0001) and female (W=0.76; p=0.0001) recruits ran the *2.4km-run* test statistically faster in the final fitness tests compared to the start of BMT. Conversely the NCPG took longer (males: W=0.29; p=0.0001; females: W=0.24; p=0.0001) to complete their 2.4km-run in their final assessment than at the start of BMT. The CPG also scored a much slower time in the initial fitness test, but at the final fitness test the two groups' times were similar. Similarly, in both groups the time taken to complete the *4km- walk* decreased significantly over time, reflecting an improvement in cardiovascular fitness (Heyward, 2002). The CPG had the largest decrease (males: W=0.69; p=0.0001; females: W=0.75; p=0.0001), showing a greater improvement than the NCPG (males: W=0.52; p=0.0001; females: W=0.67; p=0.0001).

All recruits in both groups significantly increased the number of push-ups they could do over time. Although the NCPG groups showed a significant improvement in their *push-up* test during BMT (males: W=0.39; p=0.0001; females: W=0.41; p=0.0001), the improvement seen in the CPG was statistically and practically more significant (males: W=0.75; p=0.0001; females: W=0.66; p=0.0001). Similarly all recruits in the CPG (males: W=0.0.75; p=0.0001; females: W=0.73; p=0.0001) and NCPG (males: W=0.63; p=0.0001; females: W=0.81; p=0.0001) groups significantly increased the number of *sit-ups* they could do over time. Finally, although both groups significantly decreased the time taken to complete their *shuttle- run* test, this seems to be of small practical significance (W=0.1-0.26), except for the male recruits in the CPG group (W=0.70; p=0.0001).

The results of the Chi-square analysis are presented in Table 6, which compares the proportions of the NCPG and the CPG recruits passing the Standardised Fitness Test. The majority of recruits who failed the total fitness tests during the initial fitness test were in the CPG (68.5%), which correlates with their initial lower fitness levels. However, by the fifth

week the majority of recruits who failed were in the NCPG (73.3%). By the final fitness test the NCPG had a greater percentage of recruits passing.

***TABLE 3*: VARIOUS PARAMETERS OF FITNESS TEST SCORES OF MALE CONTROL GROUP (NCGP) AND EXPERIMENTAL GROUP (CPG) FROM INITIAL TO FINAL MEASUREMENTS**

Test components	Measure-ment	Group	Mean ± SD	Mean diff.	95% CI of difference	Effect size Cohen D†
2.4km-run (minutes)	Initial	NCPG*	8.6 ± 1.0	1.83	1.47; 2.18	1.12
		CPG*	10.5 ± 1.0			
	Mid	NCPG*	**9.0 ± 0.7***	0.25	0.02; 0.47	0.25
		CPG*	9.3 ± 0.8			
	Final	NCPG*	**9.1 ± 0.8***	0.16	-0.06; 0.37	0.17
		CPG*	9.2 ± 0.6			
	Initial	NCPG*	29.4 ± 3.0	0.79	0.074; 1.50	0.23

		CPG*	30.1 ± 1.5			
4km-walk (minutes)	Mid	NCPG*	**27.7 ± 2.0***	-1.01	-1.58; 0.44	-0.39
		CPG*	**26.7 ± 1.7***			
	Final	NCPG*	27.0 ± 2.4	0.45	-019; 1.08	0.16
		CPG*	27.4 ± 1.7			
Push-ups (number)	Initial	NCPG*	39.2 ± 12.9	-7.85	-11.14; -4.56	-0.50
		CPG*	31.5 ± 9.0			
	Mid	NCPG*	47.5 ± 12.1	6.10	2.53; 9.68	0.37
		CPG*	53.6 ± 10.9			
	Final	NCPG*	53.6 ± 11.3	6.5	3.03; 9.98	0.41
		CPG*	60.1 ± 11.1			
Sit-ups (number)	Initial	NCPG*	44.8 ± 2.2	-10.08	-13.46; -6.71	-0.64
		CPG*	34.5 ± 10.1			
	Mid	NCPG*	59.5 ± 13.8	5.97	1.72; 10.25	0.31
		CPG*	65.5 ± 13.7			
	Final	NCPG*	72.4 ± 15.1	-7.03	-11.56; -2.50	-0.34
		CPG*	65.4 ± 14.2			
Shuttle runs (minutes)	Initial	NCPG*	51.2 ± 4.1	3.89	2.61; 5.18	0.64
		CPG*	55.4 ± 3.6			
	Mid	NCPG*	49.4 ± 3.2	-0.67	-1.75; 0.40	-0.14
		CPG*	48.7 ± 3.6			
	Final	NCPG*	48.2 ± 4.2	4.89	3.76; 6.01	0.93
		CPG*	53.1 ± 3.1			

* Significant changes determined by the Friedman test within the groups across the 12- week BMT period ($p < 0.05$).
† Cohen's (1988) criteria classifying effects as small (0.2-0.3), moderate (0.31-0.5) or large (>0.5).

***TABLE 4*: STATISTICAL PARAMETERS OF FITNESS TEST SCORES OF FEMALE CONTROL GROUP (NCGP) AND EXPERIMENTAL GROUP (CPG) FROM INITIAL TO FINAL MEASUREMENTS**

Test components	Measure-ment	Group	Mean ± SD	Mean diff.	95% CI of difference	Effect size Cohen D†
2.4km-run (minutes)	Initial	NCPG*	13.2 ± 2.4	3.74	3.12; 4.36	1.26
		CPG*	16.6 ± 1.8			
	Mid	NCPG*	13.5 ± 2.2*	0.10	-0.61; 0.81	0.03
		CPG*	13.6 ± 2.3			
	Final	NCPG*	12.6 ± 1.6*	0.77	0.32; 1.23	0.36
		CPG*	13.4 ± 1.4			
4km-walk (minutes)	Initial	NCPG*	33.8 ± 2.3	1.94	1.33; 2.57	0.64
		CPG*	35.6 ± 1.8			
	Mid	NCPG*	32.4 ± 2.2	-0.66	-1.36; 0.04	-0.22
		CPG*	31.7 ± 2.0			
	Final	NCPG*	30.8 ± 1.9	1.06	0.41; 1.71	0.35
		CPG*	31.8 ± 2.1			

Push-ups (number)	Initial	NCPG*	43.1 ± 13.4	-10.28	-13.69; -6.87	-0.62
		CPG*	33.0 ± 10.4			
	Mid	NCPG*	55.5 ± 14.1	2.45	-2.10; 6.99	0.12
		CPG*	57.9 ± 14.4			
	Final	NCPG*	59.5 ± 14.0	-3.15	-7.28; 0.97	-0.16
		CPG*	56.3 ± 13.7			
Sit-ups (number)	Initial	NCPG*	28.5 ± 14.7	-5.97	-9.68; -2.26	-0.33
		CPG*	24.4 ± 10.0			
	Mid	NCPG*	45.1 ± 19.0	3.45	-2.16; 9.07	0.14
		CPG*	48.6 ± 14.7			
	Final	NCPG*	56.4 ± 18.7	37.50	3.94; 71.07	0.21
		CPG*	49.8 ± 14.3			
Shuttle runs (minutes)	Initial	NCPG*	63.1 ± 6.7	5.36	3.14; 7.60	0.48
		CPG*	67.5 ± 8.1			
	Mid	NCPG*	63.8 ± 7.8	-2.09	-4.41; 0.24	-0.21
		CPG*	61.7 ± 6.1			
	Final	NCPG*	60.4 ± 6.4	4.67	2.85; 6.55	0.54
		CPG*	65.1 ± 6.0			

* Significant changes determined by the Friedman test within the groups across the 12- week BMT period ($p<0.05$).
† Cohen's (1988) criteria classifying effects as small (0.2-0.3), moderate (0.31-0.5) or large (>0.5).

***TABLE 5*: KENDALL'S COEFFICIENT OF CONCORDANCE (W) BETWEEN MEAN FITNESS MEASURES FROM BEGINNING TO END OF BASIC MILITARY TRAINING WITHIN NCPG AND CPG GROUPS**

Group	Sex	2.4km-run (min)	4km-walk (min)	Push-ups (n)	Sit-ups (n)	Shuttle run (min)
NCPG	*Male*	0.29 *	0.52 *	0.39 *	0.63*	0.20 *
	Female	0.24 *	0.67 *	0.41 *	0.81*	0.19 *
CPG	*Male*	0.68 *	0.69 *	0.75 *	0.75 *	0.70 *
	Female	0.76 *	0.75 *	0.66 *	0.73 *	0.26 *

* Significant changes determined by the Friedman test within the groups across the 12-week BMT period ($p < 0.05$)

***TABLE 6*: COMPARISONS OF CONTROL (NCPG) AND EXPERIMENTAL (CPG) GROUP OF RECRUITS PASSING THE FITNESS ***

Test	Group	Proportion passing (%)	p-value #
Initial	NCPG	63.4	0.0001
	CPG	20.2	
Mid	NCPG	87.3	0.0200
	CPG	95.0	

Final	NCPG CPG	96.6 92.5	0.0900

* Passing the Standardised Fitness Test requires obtaining a score of 600 points or more on each of the test events based on age and gender adjusted performance standards (DOD policy on Physical Training, Department of Defence Instruction: SG no 00006/2000).

p-value represents the significance of differences (chi-square test of proportions)

DISCUSSION

Despite the male and female recruits in the CPG having a significantly poorer initial fitness level than those in the NCPG at the start of BMT, the CPG improved sufficiently to be as fit as the NCPG by the end of the 12-weeks of BMT. The CPG recruits who trained according to the new cyclic-progressive PT program yielded superior performance in men's push-ups after the BMT period, whilst the NCPG that followed the traditional PT program measured better performance in all other fitness measurements. What should, however, be noted is that the CPG experienced the greatest amount of change in performance measured. Of interest is that the greatest improvements shown by the CPG, in these components, were achieved by week five of BMT.

The cohort completed 48 periods of PT consisting of 40 minutes each, over the 12-week period (Department of Defence, 2000). This differs from the PT program reported by Knapik *et al.* (2005) where the participants, over a nine-week period, completed 45 periods of PT (60 minutes each) and where almost half the 90 periods were allocated to the regular recruits on 12 weeks of British BMT (Williams, 2005). The PT program followed by the SANDF in the

1980s included 50 PT periods of 40 minutes each over a 10-week period. The SANDF's standard fitness test utilises the 2.4km-run and the 4km-walk as its test for aerobic fitness. The comparison of fitness levels is difficult as armies around the world utilise different measures. The American Military utilises the 1mile- and 2mile-run (Popovich *et al.*, 2000; Armstrong *et al.*, 2004; Knapik *et al.*, 2005; Knapik *et al*., 2006; Rauh *et al*., 2006; Smith & Petersen, 2007), the Norwegian Military (Heir & Eide, 1997; Dyrstad *et al.* 2006) makes use of a 3km-run, whilst the British and New Zealand armies (Scully & Besterman, 1982; Stacy *et al*., 1982; Harwood *et al*., 1999) use the 2.4km-run as their test of aerobic fitness.

A confounding factor is that the length of BMT also differs from country to country. Studies have reported changes during a 6-week BMT course in Britain (Daniels *et al.* 1979); the New Zealand army have reported changes during BMT of 10 weeks in length (Stacy *et al.*, 1982); whilst the SANDF has a 12-week BMT course. Regardless of the measurement used to assess aerobic fitness, changes, if any, in aerobic fitness could be assessed, and the effect of the new PT program was ascertained by comparing the results of the CPG to those of the NCPG.

The male and female recruits showed greater improvement in aerobic ability, which may be attributed to the 46% more time spent by the CPG jogging and the training stimulus offered by the respective programs. However, the regression to the mean phenomenon is always a factor that needs to be considered. As with other studies (Hillsdon *et al*., 2002; Carnethon *et*

al., 2003), participants in the NCPG had a good initial run time and tended to decrease slightly whilst, although the CPG had an initial slower time, they had the potential to have a much higher potential improvement. Additionally, it appears that there may have been a ceiling effect in both groups for the walk test, as the percentage improvement is far less with the walk test than with the run test and both are a measure of aerobic performance. Both programs therefore provided sufficient training stimulus for cardiovascular measured performance.

Muscle endurance was indirectly measured by the push-up and sit-up test. The initial amount of push-ups performed by the male recruits in both the CPG and NCPG is similar to that performed by other recruits at the start of BMT in other areas of the world (Scully & Besterman, 1982; Jones *et al*., 1994; Knapik *et al.,* 2004). With their upper body muscle endurance in both the CPG and NCPG showing significant increases in the amount of push-ups they could do over time, the South African female recruits performed a far greater amount of push-ups than other female recruits starting BMT (Jones *et al.,* 1994; Bell *et al*., 2000; Knapik *et al.,* 2004). The female recruits had changes over the 12-weeks that were similar to those of the males, with significant improvement seen in both the CPG and NCPG. However, the latter was more pronounced.

The initial amount of sit-ups performed by the male and female recruits in both the CPG and NCPG was lower than that performed by other recruits at the start of BMT in other areas of the world (Jones *et al.,* 1994; Beck *et al.,* 2000; Bell *et al.,* 2000). Both the CPG and NCPG had significant increases in the amount of sit-ups they could do over time. However, the CPG showed their greatest improvement by the fifth week of BMT, whilst the NCPG showed a steady increase until the end of the 12 weeks of training. Similarly, the initial abdominal muscle endurance of the female recruits was found to be poorer than that performed by other female recruits at the start of BMT in the British and American armies (Jones *et al.,* 1994;

Beck *et al.,* 2000; Bell *et al.,* 2000). Both the CPG and NCPG had significant increases in the amount of sit-ups they could do over time, with the CPG showing the greatest increase in the first five weeks.

The improvements in muscle endurance as measured by the sit-up and push-up test, are similar to the findings of other researchers who documented similar changes in these two parameters during BMT (Bell *et al.,* 2000; Evans *et al.,* 2005; Knapik *et al.,* 2005; Dyrstad *et al.,* 2006; Knapik *et al.,* 2006). Both the male and female subjects in the CPG were initially weaker in both push-ups and sit-ups performed than NCPG. However, by the fifth week of BMT the recruits in the CPG performed statistically more sit-ups and push-ups than the NCPG. This may be attributed to the greater amount of upper body and abdominal muscle endurance exercises done by the CPG. However, it appears that the training stimulus offered by both the programs was equivalent for the female sit-up and push-up performance, whilst the new PT program appears to have yielded a superior training effect on the men's upper body muscle endurance. This may be attributed to the additional resistance offered by the wooden poles used and should be investigated in a larger sample of female recruits. Additionally, a possible area of improvement in the new PT program is to increase the progression from the fifth week to possibly counteract the plateau observed in both parameters in the male and female recruits.

The shuttle-run test, as prescribed by the Department of Defence (DoD) Policy on Physical Training, (Department of Defence, 2000) is not a standardised test (as used by other studies), which does not make comparison of results possible. Although the CPG did have a significant improvement in comparison to the NCPG, the training stimulus offered by the traditional PT program ensured that the NCPG performed better on the final shuttle-run test.

In conclusion, the new cyclic-progressive PT program which was implemented for the first time for the period of this study elicited more change in fitness parameters as measured by the Standardised Fitness Test than the traditional PT program, although it only yielded superior performance at final measurement in the men's push-up. This may be attributed to the relatively greater amount of upper body exercises performed by the CPG and by the additional resistance offered by the pole PT. Apart from operational fitness that has been the main aim of a PT program, another aspect which needs to be included in further investigations is the effect of the new PT program on injuries.

PRACTICAL APPLICATIONS

As a result of this comparative study, the new cyclic-progressive PT program was mandated for all BMT units across the SANDF in 2009. All training of the PT instructors is centralised at the Joint Physical Training Sport and Recreation unit, ensuring that standardised training occurs throughout the SANDF. The study further reinforces the effectiveness of following BMT principles of exercise prescription, specifically the principles of progression and overload (Heyward, 2002; ACSM, 2006). In BMT, the PT program cannot be individually tailored to each recruit due to the large number of recruits, as well as the cost and space required to incorporate resistance training based in a gymnasium. This is neither logistically nor financially viable in the SANDF. Thus, the economical wooden pole PT has been successfully included in the training, providing an effective resistance training method for the large number of BMT recruits. Upper body strength is a vital component of fitness for the military recruit. It is necessary for weapon handling and operational execution, thus assisting to achieve the BMT objectives. With the decline in the levels of physical fitness amongst the younger generation, the importance of starting the PT program gradually (increasing the exercise intensity) is highlighted. The effectiveness of the program is still being continuously monitored using fitness outcomes as a measure of success; however, future endeavours should also include injury rates as measures of program effectiveness.

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Dr. Paola WOOD: Department of Biokinetics, Sport and Leisure Sciences, University of Pretoria, Private Bag X20, Hatfield 0028, Republic of South Africa. Tel.: +27 (0)12 420-6046, Cell: +27 (0) 74 323 1535, Fax.: +27 (0)12 420-6099, E-mail: paola.wood@up.ac.za

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POSSIBLE MECHANISMS OF THE BENEFIT OF ONE-DAY CHALLENGE ROPES COURSES

Chung-Chi WU *, Chih-Mou HSIEH ** & Wei-Ching WANG ***
**Department of Recreational Sport and Health Promotion, National Pingtung University of Science & Technology, Pingtung, Taiwan*
***Department of Civil Education and Leadership, National Taiwan Normal University, Taipei, Taiwan*
****Department of Tourism, I-Shou University, Kaohsiung, Taiwan*

ABSTRACT

To identify possible mechanisms of benefit of one-day ropes courses, a hypothetical structural equation model based on previous research was proposed. To test the hypotheses, a survey was conducted. Utilising purposeful sampling, 279 high school students participating in a one-day ropes course programme at the

National Taiwan Sports University participated. The original hypothesized model was rejected and replaced with an alternative, in which three important mechanisms (preparation for learning, processing of activities and characteristics of experiences) were identified as benefiting participants in ropes course programs. These concepts were viewed as antecedent and mediating variables in the revised model. Further hypotheses regarding (adventure-related) experiential learning were discussed. It was suggested that three mechanisms benefiting participants be applied by experiential educators:
(1) having participants prepare for learning in advance and implementing sequenced processing in course design; (2) presenting a comprehensive programme starting with warm-up activities and ending with debriefing and reflection; and (3) optimising every participant's experience, as several learning opportunities are possible within a single activity.

Key words: Adventure-based recreation; Ropes courses; Mechanisms benefit; Outdoor adventure education.

INTRODUCTION

Benefit of ropes courses

Outdoor adventure education can take on many forms, such as backpacking, rafting, orienteering, hang-gliding and ropes courses (Ewert, 1989). Ropes courses can be described as "any program that utilizes belayed, spotted or non-spotted elements/activities designed or installed as part of an (adventure-related) experiential learning curriculum" (Association for Challenge Course Technology, 1998:23). Ropes courses are an effective training modality to instil intra- and interpersonal skills growth in young participants and have become popular (Rohnke, 1986; Rogers, 2000), in many countries because of their associated beneficial and significant outcomes. Compared with other outdoor activities, which can be less accessible and involve travelling, ropes courses are relatively more accessible.

Participation in a program that includes ropes course experiences has been found to yield intra- and interpersonal benefits to various target groups. These include improved self-efficacy in high school students (Constantine, 1993), enhanced self-concept in male and female undergraduate students (Finkenburg *et al*., 1994), benefits to children with cerebral palsy (Carlson & Evans, 2001), and improved resilience in 25 minority adolescents of low-income status (Green *et al*., 2000). Robitschek (1996) examined 98 at-risk youth and reported improvement in feelings of hope after a one-day program that included ropes course activities. Eagle (2000) found an improvement in self-concept and life skills for an experimental group consisting of 74 students participating in challenge ropes courses. Sibthorp (2000) argues that outdoor adventure education benefits physical fitness and increases outdoor-related specific knowledge and skills. Hatch and McCarthy (2005) published research reporting the significant skill improvements of a group of 76 college students who participated in a half-day program that included ropes course activities. The possible benefits they identified were physical fitness, specific skills, social skills and life skills.

Possible mechanisms of benefit derived from ropes courses

Though the above studies indicate several positive outcomes of ropes courses, behavioural scientists suggest that the causes behind these benefits remain vague (McKenzie, 2000; Baldwin *et al*., 2004). Thus, a fuller understanding of why ropes courses can be beneficial calls for further scientific enquiry.

Researchers have tried to ascertain the reasons behind the observed benefits of ropes courses to participants. In this study, these reasons are referred to as: „mechanisms of benefit". Their scope is all positive changes resulting from participation in a one-day programme that includes participation in a ropes course, among other activities. Suggested indicators (Ewert, 1988; Marsh & Richards, 1989; Sibthorp & Arthur-Banning, 2004), include participants" intentions and expectations with regard to outdoor adventure programs, as well as their willingness to be challenged to change before participation. These may constitute key antecedent variables that help with the identification of benefits.

Moreover, Outward Bound instructors noted several mechanisms of benefit, such as th e power of the group process, problem-solving situations, concrete experiences, structured reflection and the element of adventure via observation during the activities they supervised (Hopkins & Putnam, 1993). Luckner and Nadler (1997), argued that learners may benefit because of new relationships formed, increased kinaesthetic awareness during participation and risk-taking that encourages learning. Based on an Australian study, Neill and Dias (2002) pointed out that social support from instructors and group members can significantly predict program outcomes. This enhances the psychological resilience of the participants to survive and thrive across varied circumstances. Several other studies, mainly conducted by McKenzie (2000) and Sibthorp (2003), have also yielded useful findings.

McKenzie (2000) identified six characteristics of a programme (physical environment, activities, processing, the group, the instructors, and the participants) that result in positive outcomes. In a later study, McKenzie (2003) proposed five factors that affect programme benefits: physical environment, social environment, activities, instructors and group members. Sibthorp and his colleague (Sibthorp 2000, 2003; Sibthorp & Arthur-Banning, 2004), conducted studies to identify characteristics of the adventure education experience, namely „personal empowerment" and „social support". The characteristic „social support" includes the instructors and group members. Another characteristic identified was „learning relevance", which refers to student generalisations between course content and personal life (Sibthorp & Arthur-Banning, 2004:38). Haras and Bunting (2005) noted that elements of challenge, uncertainty, risk, novelty and fun, variety in activities, self-selected roles for participants and providing a variety of challenging options are specific characteristics provided by ropes courses.

***TABLE 1*: POSSIBLE MECHANISMS OF BENEFIT FOR ROPES COURSES**

	Mechanisms of benefit & Possible factors		
	1. Preparation for learning	**2. Processing of activities**	**3. Characteristics of experiences**

Studies and papers	1-1	1-2	1-3	2-1	2-2	2-3	2-4	2-5	2-6	3-1	3-2	3-3	3-4	3-5
Ewert (1988)			X											
Haras & Bunting (2005)				X	X									X
Hopkins & Putnam (1993)						X	X		X	X		X		
Luckner & Nadler (1997)				X	X	X	X	X	X	X	X	X		
Marsh & Richards (1989)	X													
McKenzie (2000)				X	X	X	X	X	X				X	X
McKenzie (2003)					X	X	X	X					X	
Neill & Dias (2002)													X	
Sibthorp (2000)									X				X	X
Sibthorp (2003)									X				X	X
Sibthorp & Arthur– Banning (2004)		X							X					X

1-1= participant intention
1-2= participant expectation
1-3= willingness to change

2-1= state of disequilibrium
2-2= sense of mission or challenge
2-3= team building through collaboration
2-4= mastery within successful experiences
2-5= role of facilitator
2-6= debriefing and reflection

3-1= kinesthetic imprint
3-2= immediate feedback
3-3= encouraging adventure
3-4 = social support
3-5 = empowerment

X = Discussion of denoted factor in prior studies and papers

Although several possible mechanisms of benefit have been proposed, some perspectives lacked empirical data and integration thereof. For example, in the study by Neill and Dias

(2002), focus was only given to the possible mechanism of „social support" and the work by Hopkins and Putnam (1993), and Luckner and Nadler (1997), lacked sufficient empirical support. Consequently, integration of the potential factors and the design of an empirical model are still necessary. In order to clarify this, the possible mechanisms of the benefits of ropes courses were categorised according to characteristics identified in the literature review. Fourteen possible mechanisms of benefits of ropes courses drawn from previous studies were grouped into three categories (Table 1):

- *Preparation for learning*: participant intention, participant expectation and willingness to change;
- *Processing (sequencing) of activities*: state of disequilibrium, sense of mission or challenge, team building through collaboration, mastery through successful experiences, role of facilitator, and debriefing and reflection;

- *Characteristics of experiences*: kinaesthetic awareness, immediate feedback, encouraging for adventure, social support and empowerment.

In the current study, the specific hypotheses to be tested are as follows:

H1: „Preparation for learning" correlates positively with „processing of activities"; H2: „Preparation for learning" correlates positively with „benefits of activities".

H3: „Processing of activities" correlates positively with „benefits of activities".

H4: „Processing of activities" correlates positively with „characteristics of experiences". H5: „Characteristics of experiences" correlates positively with „benefits of activities".

PURPOSE OF THE STUDY

The purpose of the present research was to construct a model for the mechanisms of benefit of ropes courses. By adopting concepts from multiple disciplines, as well as incorporating suggested mechanisms, a hypothetical model is proposed. In this model, „preparation for learning" was regarded as an antecedent variable for „processing (sequencing) of activities" and „benefits of activities". Another variable, „characteristics of experience", was regarded as a mediating variable between „processing (sequencing) of activities" and „benefits of activities". To clarify the mechanisms, the relationships among all variables were examined and verified based on the two study objectives adopted:

(a) to examine the relationships among the variables „preparation for learning", „processing of activities", „characteristics of experiences" and „benefits of activities"; and
(b) to provide practical examples of an enhanced design of such programmes.

METHODOLOGY

Participants

Research participants were students from three high schools participating in a one-day programme that included ropes course activities at the National Taiwan Sports University

from March to April 2006. The participants voluntarily took part in the research project and were remunerated for their time. Of the 300 questionnaires distributed, 279 were returned (93% response rate). Among the 279 participants, 124 were males (44.4%) and 155 were females (55.6%), and the average age of participants was 14.3 years (SD=1.20).

Measures

All measures were adopted or transferred from related research material and statements in past studies. Designed items were rated on a 5-point Likert scale as follows: 1=strongly disagree; 2=disagree; 3=neutral; 4=agree; and 5=strongly agree. To enhance the measurement variables, a series of analytic procedures were applied to the responses,

including item analysis, exploratory factor analysis (EFA), reliability analysis (Cronbach‟s alpha) and confirmatory factor analysis (CFA).

Preparation for learning is an 8-item measure constructed from related concepts and statements taken from Sibthorp (2003), and Sibthorp and Arthur-Banning (2004). *Processing/sequencing of activities* is an 18-item measure constructed from related research material and statements (Hopkins & Putnam, 1993; Luckner & Nadler, 1997; McKenzie, 2000; Haras & Bunting, 2005). *Characteristics of experiences* are a 17-item measure consisting of 5 subscales extracted. After the EFA, the dimensions were adapted from related concepts and statements by Hopkins and Putnam (1993), Luckner and Nadler (1997), McKenzie (2000, 2003), Sibthorp (2000, 2003), Neill and Dias (2002), and Haras and Bunting (2005). *Benefits of activities* are a 15-item measure adapted from related concepts and statements by Ewert (1989), Neill (1999) and Sibthorp (2000).

Programme design

Four components, namely socialising games, group initiative activities (warm-up and ice-breaker games), low ropes elements and high ropes elements comprised the day-long programme. The main purpose of socialising games was to allow participants to get to know one another and become acquainted with the facilitator. The aims of group initiative activities were to establish some initial levels of trust and team work. Low ropes elements consisted of a series of problem-solving activities at ground level or 1-3m off the ground, and were designed to afford participants opportunities to experience cooperation, trust and problem-solving through spotting (physical support provided by fellow participants) or belaying the ropes. High ropes elements consisted of a series of individual and group (1-3 participant) challenges at an average height of 15m suspended by 18m poles and a network of cables.

Upon arrival, participants were introduced to the facilitators, who then reviewed the activities that would comprise the 1-day ropes course. The participants were exposed to 2 socialising games followed by 2 problem-solving activities. The 2 socialising games („name dance‟ and
„moon ball‟), and the 2 group initiative activities („key punch‟ and “wind in the willows‟), followed by completing 1 low ropes activity („the wall‟) and 2 high ropes activities („cat walk‟ and „pamper pole‟), comprised the activities of the programme. During the 1-day adventure-related experiential learning programme that including ropes courses experiences, facilitators provided safety guidelines, as well as debriefing experiences to enhance reflection and learning.

Procedures

In order to investigate the mechanisms of benefit of 1-day ropes courses, questionnaires were distributed to participants after they had completed the whole course. One of the authors distributed the questionnaires and was present to assist participants when guidance was required. The questionnaire took approximately 10 minutes to complete in a quiet setting. Participant confidentiality and anonymity were assured.

Analysis

LISREL 8.54 software was employed to identify positive outcomes (constructs) of this adventure-related experiential learning programme. Statistical indices for goodness-of-fit (Hair *et al*., 1998), were used to assess the model‟s adequacy for both the CFA and Structural Equation Modelling (SEM), including: (1) chi-square statistics; (2) standardised root mean square residual (SRMR); (3) goodness-of-fit index (GFI); (4) non-normed fit index (NNFI); and (5) adjusted goodness-of-fit index (AGFI). Values greater than 0.90 for indices (3) to (5) were taken to indicate adequate fit of the model.

RESULTS

Model identification and modification

To test the proposed hypotheses, a path analysis was conducted to evaluate the core relationships among the measures for „preparation for learning‟, „processing of activities‟, „characteristics of experiences‟ and „benefits of activities‟.

Preparation for learning
Through the EFA (exploratory factor analysis), 3 factors were extracted, namely participant intention‟, „participant expectation‟ and „willingness to change‟ - and explained with 71.5% variance. Cronbach‟s alpha value for the 3 subscales ranged from 0.72 to 0.87.

Processing/sequencing of activities
Six factors, namely „state of disequilibrium‟, „sense of mission or challenge‟, „team building through collaboration‟, „mastery through successful experience‟, „role of facilitator‟ and „debriefing and reflection‟ were extracted by the EFA and explained with 65.6% variance. Cronbach‟s alpha value for their 6 corresponding subscales ranged from 0.65 to 0.88.

Characteristics of experiences
The total scale yielded an explained variance of 69.3%, while Cronbach‟s alpha for the 5 subscales ranged from 0.72 to 0.83.

Benefits of activities
The EFA yielded 4 factors, which were „physical fitness‟, „social skills‟, „specific skills‟ and „life effectiveness‟. The total scale returned an explained variance of 63.5% and Cronbach‟s alpha ranged from 0.75 to 0.85 for the 4 subscales.

Construct common to the factors
The results of the CFA (Confirmatory Factor Analysis) indicated the dimensions of the model matched the distribution of observation data from the current study.

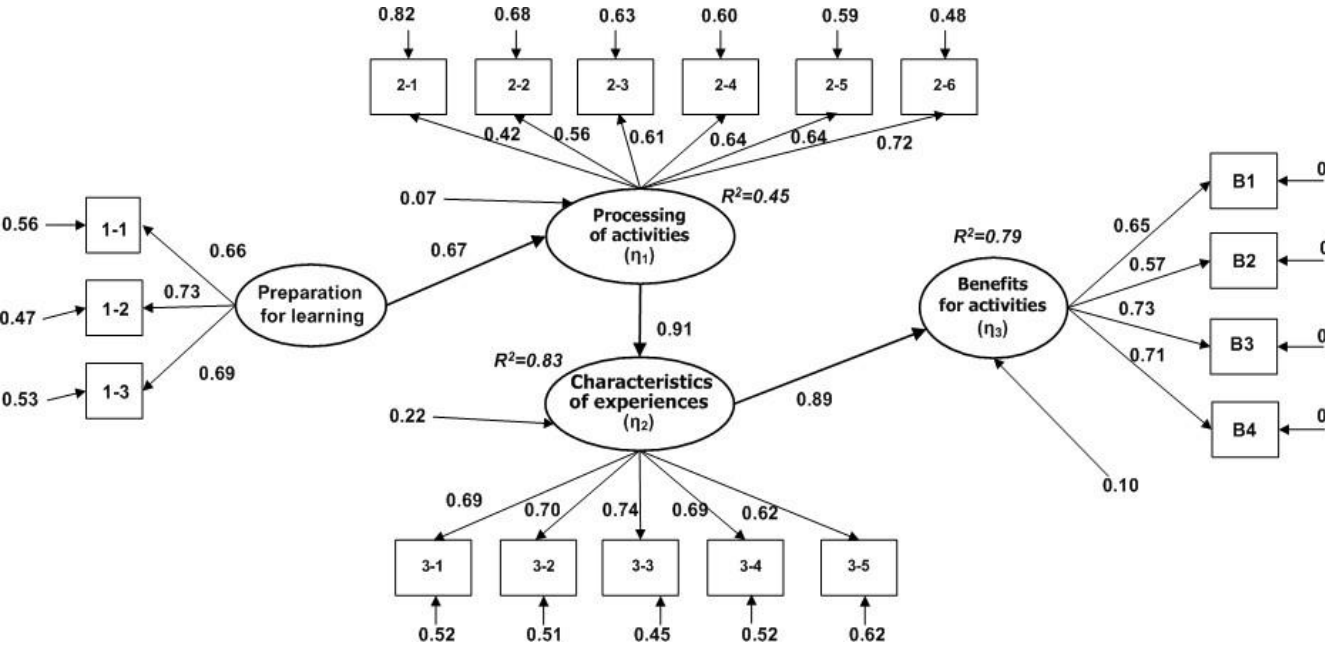

***FIGURE 1*: ALTERNATIVE MODEL AFTER MODIFICATIONS**

KEY: Standardised coefficients are reported. Significant= $p < 0.05$; (ns) = Non-significant Possible

1-1= participant intention disequilibrium
1-2= participant expectation challenge
1-3= willingness to change
2-1= state of
3-1= kinesthetic imprint
2-2= sense of mission or
3-2= immediate feedback
2-3= team building through collaboration
3-3= encouraging adventu
2-5= role of facilitator
3-5= empowerment 2-6=
B1= physical fitness B2= specific skills B3= social skills B4= life effectiveness

In the hypothesised model, the relationships between „preparation for learning" and „benefits of activities" and between „processing of activities" and „benefits of activities" were not significant at the 0.05 level (β = 0.04 and -0.01, respectively). Figure 1 depicts the adapted model after subsequent modification. Overall, the goodness-of-fit indices supported the adapted structural model, showing it to fit the data reasonably well ($\chi 2$ = 242.75, df = 132, $p<.05$; GFI = 0.91; AGFI = 0.89; SRMR = 0.04; NNFI = 0.98: and Normed $\chi 2$ = 1.84). In the modified model, 2 paths were dropped, including „preparation for learning" to „benefits of activities" and „processing of activities" to „benefits of activities".

According to the literature reviewed, both measures of „preparation for learning" and of „processing of activities" could be antecedent characteristics of benefits. However, it should be noted that in the studies reviewed, those factors were usually considered separately when testing their influences on benefits. In contrast, this study had all variables considered together in the model. Therefore, some variables could have influenced one another.

Hypotheses tested

Figure 1 indicates the standardised coefficient for each path in the model. First, the data supported Hypotheses 1, 3 and 4 as formulated earlier. The „preparation for learning" variable significantly predicted „processing of activities" (pathway coefficient β=0.67); „processing of activities" significantly predicted „characteristics of experiences" (β=0.91); and there was a significant correlation between „characteristics of experiences" and „benefits of activities" that was found to be β=0.89. Standardised path coefficients, which can be interpreted as regression weight (β) or correlation coefficients (R) can be seen in Figure 1.

Based on the coefficients between latent variables displayed, 3 paths for mechanisms of benefit were revealed:

1. „Preparation for learning" → „processing of activities" → „characteristics of experiences" → „benefits of activities." This path showed indirect effects as well as a standardised coefficient of 0.54 (= 0.67×0.91×0.89).
2. Processing of activities" → „characteristics of experiences" → „benefits of activities." This path also showed indirect effects as well as a standardised coefficient of 0.81 (= 0.91×0.89).
3. „Characteristics of experiences" → „benefits of activities." This path showed direct effects with a standardised coefficient of 0.89.

DISCUSSION

This study contributes to the development of theory that explains the possible mechanisms of benefit behind adventure-related experiential learning as determined by a literature review. Furthermore, an integrative model was proposed by incorporating mechanisms suggested in past research. The current study tested an integrative model to examine the relationships between „preparation for learning", „processing of activities", „characteristics of experiences" and „benefits of activities". The model was empirically tested using survey data from 279 participants of a one-day adventure-related experiential learning programme that included ropes course activities.

The study results indicated that „preparation for learning" had no direct effect on „benefits of activities", but indirectly influenced it through the „processing of activities" and „characteristics of experiences" variables. This result was somewhat different from what was expected. Previous studies (Ewert, 1988; Sibthorp & Arthur-Banning, 2004), regarded participants" intentions and expectations and willingness to change as antecedent variables for benefits. However, after considering these variables and comparing them with two others, „processing of activities" and „ characteristics of experiences", the effect seemed to be mediated by the other two variables. Thus, the effect of „preparation for learning" on „benefits of activities" appear to be mediated by first „processing of activities" and then „characteristics of experiences", which both act as antecedent variables of „benefit of activities". In the same way, the elements of „processing of activities" were also regarded in previous research as factors that could lead participants to achieve goals of personal growth (Sibthorp & Arthur-Banning, 2004; Haras & Bunting, 2005). However, in this study, the influence of „processing of activities" on „benefit of activities" seemed also to be mediated by „characteristics of experiences".

Based on these results, it can be concluded that the two variables „processing of activities"

and „characteristics of experiences" seemed to play a mediating role in the model. There were also some specific factors at work in the sequence of the adventure-related experiential learning programme. For example, the design of a programme that includes ropes course activities provides a particular state of disequilibrium. Through a series of sequenced activities, such as warm-ups, socialising, as well as low and high ropes elements and skilled facilitation, participants were expected to achieve a certain level of teamwork. Moreover, the programme is designed to conclude each activity with a debriefing that includes in-depth reflection, which can help create a meaningful experience easily transferable to real-life settings (Fleming & Martin, 2007; Johns & Henwood, 2009).

Other benefits of the inclusion of ropes courses in adventure-related experiential programmes are the unique „characteristics of experiences". Such characteristics include: (a) „kinaesthetic imprint", meaning participants can learn through experience; (b) „immediate feedback" and „social support" from group members and facilitators as well as „encouraging adventure" to help participants take on challenges; and (c) „individual or group empowerment" to allow participants take responsibility for decisions. These findings are similar to those of former studies (Sibthorp, 2000, 2003; Neill & Dias, 2002). The unique characteristics help participants work together and support one another. On the other hand, participants can also obtain immediate feedback and support from other participants. Encouragement by fellow team members has an empowering effect and participants end up doing challenging activities they never thought possible.

The above illustrates an interesting point for future research. It could be argued according to this model that the positive benefits derived from adventure-related experiential learning programmes occur more directly because of the unique characteristics of the programme design and content, like kinaesthetic imprint, immediate feedback and encouragement to participate in challenging activities and empowerment and social support from fellow participants. The results of this study indicate that these characteristics actually play a significant role in the generation of benefits and preparing participants for learning. In other words, to enhance the benefits of adventure-related experiential learning programmes, not

only the variables „preparation for learning" (in advance) and thorough „processing of activities" are needed, but the item „specific characteristics" is indispensable to adventure-related experiential learning and helps to distinguish it from other learning methodologies.

IMPLICATIONS

This research offers some insight into the benefits of ropes courses that are integrated with adventure-related experiential learning programmes; however, certain limitations should be noted. The first limitation was the sample of school children. All of the participants in this study were students at a school for outdoor adventure education. Generalisation and application of these research findings to business environments or adventure therapy requires further scientific inquiry. The 5 -point Likert scale can be regarded as the second limitation of this research. This tool only provides two options for measuring a positive experience and the same experience is used to generate other data. This may threaten the validity of the data through the common methods variance introduced. A variety of measuring tools or approaches, such as an extended range of the point scale or qualitative approaches like in-depth interviews and participant observation, could be used in research

methodologies to obtain more accurate information from the respondents. Moreover, because of time constraints, the research team chose to administer all questionnaire items immediately after the experience. In future research, the distribution of the questionnaires could be staggered according to the different phases of the experience. In addition, future research could employ a larger variety of research models to identify a superior fit.

Considering the conclusions of this research, practitioners should be reminded to include as many factors as possible when developing an adventure-related experiential learning programme. Managing participants‟ learning expectations in advance and implementing an orderly sequence of activities to create an atmosphere conducive to proper adventure experiences can ensure positive benefits. For example, sharing a former case of success or providing an explanation of the course beforehand might help to enhance the participants‟ intentions, expectations and willingness to change. Moreover, to ensure that the participants decide to participate in a given programme, an inquiry of their inclinations is also necessary.

The completeness of the programme process, starting with warm-up activities and ending with debriefing and reflection, is important. Participants are encouraged to accomplish their mission based on the confidence and trust built through preceding activities. In the process, a facilitator plays an important role in instruction and guided reflection. By listening, observing and raising questions, a facilitator could assist participants to overcome their fears and share their true feelings with one another. Therefore, it would be better for a small group (7-15 persons) to be allotted one or two facilitators. Moreover, the results of this study showed that a state of disequilibrium is a factor that enhances the beneficial effects of ropes courses. To generate a state of disequilibrium in participants, increasing the degree of difficulty of the activity would be a significant approach to take during course design.

The five „characteristics of experiences‟ (kinaesthetic imprint, immediate feedback, encouraging adventure, social support and empowerment) are key factors that determine the value of ropes course experiences. In the courses, participants should be empowered and

encouraged to overcome physical and emotional challenges, both by themselves and when cooperating with other group members. Once the challenge is overcome, the facilitator should give immediate feedback to the participants. It is particularly noteworthy that several activities are usually designed within a programme, but due to time limitations not every participant has the opportunity to experience all activities. In this situation, participants might lose the chance to experience some course benefits. Therefore, the final suggestion is to ensure that every participant is exposed to all benefits of all activities. There should thus be no hesitation to allow participants to experience all of the unique processes available in challenge ropes courses.

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Prof. Wei-Ching WANG: Department of Tourism, I-Shou University, Kaohsiung, 4F., No 235, Jhongjheng 4th Road, Kaohsiung City, Taiwan 80147. Tel.:+886-7-2234017, E-mail:piano@kcg.gov.tw

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