Cardiff School of Sport

DISSERTATION ASSESSMENT PROFORMA:

Empirical [1]

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Dissertation title:	Work Rate Analysis Examining Positional Demands in University Soccer		
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Comments	Section
	Title and Abstract (5%) Title to include: A concise indication of the research question/problem. Abstract to include: A concise summary of the empirical study undertaken.
	Introduction and literature review (25%) To include: outline of context (theoretical/conceptual/applied) for the question; analysis of findings of previous related research including gaps in the literature and relevant contributions; logical flow to, and clear presentation of the research problem/ question; an indication of any research expectations, (i.e., hypotheses if applicable).
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Work Rate Analysis Examining Positional Demands in University Soccer

Dissertation submitted under the discipline of

Performance Analysis

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Work Rate Analysis Examining Positional Demands in University Soccer

Cardiff Metropolitan University

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Abstract

The purpose of this study was to examine 20 different collegiate/amateur players to test for a difference in work rate levels in 5 different positional roles. As well as this an assessment of intermittent nature at this level was also a topic of study. The twenty different players examined included a majority 17 university standard players from the BUCS championships but also three players from high standard amateur Welsh leagues. The positional categories were split up into five, namely, central defenders, wide defenders, central midfielders, wide midfielders and forwards. Voice recordings were used to describe the performance of each individual player, this data was then coded in a software called DOSbox. As two observers were used a reliability match was arranged and using Altman's (1991) guidelines of Kappa an acceptable 'moderate' strength of agreement was found. After a Shapiro-Wilkes test found numerous significant differences to normality ($p.<0.05$) suggesting a one way ANOVA test would be appropriate to compare the different positions. Numerous different findings were found which included a drop in high intensity outputs from the first half to the second half (9.2±1.6 to 8.4±1.6) as well as the different frequencies and durations of each variable in each position. The conclusions drawn from this result make different suggestions for improvements for example central midfielders could benefit from interval training.

Chapter One: Introduction

Chapter One: Introduction

1.1 Background

Association football (commonly known as soccer) is widely acknowledged to be the most popular sport in the world (Giulanotti, 1999). A team wins by scoring more goals than their opponent and if a team is to succeed then they must have the ability to score goals (Hughes and Churchill, 2005). Soccer is considered a fast moving game and it is often called upon for players to have good levels of fitness. Players usually have to output short intense activities intermittently, whilst also sustaining longer periods of low-level activity for example a walk or slow jog (Reilly, 1997). Players often are requested to compete/train months before their competitive season so that they are physically ready to compete at their respective level. With financial levels growing among clubs and growing popularity that has developed over previous years, each team is looking at different ways to get ahead of their opponents for example many clubs now have a team of performance analysts.

In order to be ready to compete, tests are carried out on players to examine their levels of fitness. Other ways in which fitness is examined is to examine what percentage of a game an athlete spends in work and rest. The optimum way in which this is measured is through time motion analysis systems. This is an objective method for quantifying player movements and provides information on what is required in this particular area of the game (Rudkin and O'Donoghue, 2008).

1.2 Aims

The aim of this study is to investigate (in five different positions) seven different movement classifications and how often they occur during a full ninety minute soccer match. Once this data has been collected it can be used to create profiles in the chosen positions so the demands at this level can be discovered and different training patterns could potentially be produced.

1.3 Purpose

As there is currently limited research at University level soccer in the field of time motion analysis it seemed appropriate to assess the work-rate levels of players at this level. The different positions examined during the study included, central

defenders, wide defenders, central midfielders, wide midfielders and forwards. Studying twenty matches, analysing each of the separate positions four times a movement profile can be created. Using this data coaches could utilize this and discover what attributes are required in each position and what would be the most effective way to train each individual player.

1.4 Participants

The teams used to gather the data were Cardiff Metropolitan 1st team and Cardiff Metropolitan 2nd team as well as their opponents during the 2013/2014 season. This included games from the BUCS Championships as well as the Welsh League Division three and the Welsh League Reserve Division Central. This suggests that although amateur games were viewed the players still possessed the quality needed to get reliable results. The teams had no players that were much below par and could affect the results by being at the bottom end of the spectrum at this level.

The style of play at this level is often deemed worse as players lack the quality to keep possession as professional players do so. Therefore this research could be used in the future by analysts/coaches as there has been little research that has gone before this in relation to time motion analysis at amateur level. However it is important for any future studies to consider that soccer is a rapidly changing game and different systems are always being developed (Bradley et al. 2009).

1.5 Limitations

The conclusions drawn from the study may not be applicable in all situations in soccer, for example it is likely that the data couldn't be utilized by elite level clubs, female soccer clubs or amateur level clubs in foreign countries. This is due to the fact that a player's work-rate can be affected by different factors for example fitness levels player, playing style or the game location. Although four players will be examined in each position because of the nature of amateur level soccer, potentially a greater range of movement could be seen opposed to elite level soccer studies that have gone before.

Although the number of players used during this study (20) aims to eliminate majority of anomalies it is not as many as previous time motion analysis studies for example Bloomfield*et al.*(2007). It is thought more subjects used during a study of this nature

will lead to more reliable results and give less room for a drastic range in results. Also this study only examines games from one part of the country and may not give a true account of teams from not only different countries but also different parts of country although there is no evidence to suggest that the data may vary.

1.6 Definition of Terms

Time motion analysis techniques are used as a method to create profiles that can be used to analyse athletic performance. Decades ago manual coding systems have been used but since being proved inaccurate (often by some distance) more modern systems have been created such as Prozone which is used to measure distances covered and at what intensity (Carling and Bloomfield, 2013).

Work-Rate is defined as the ratio between that of when the athlete is working at a high intensity and a low intensity (Prim and van Rooyen, 2013). This is considered to be important within soccer because of its intermittent nature, meaning that to be successful, players to have high levels fitness (Reilly, 1997). Intermittent nature of soccer is the suggestion that multiple high intensity-bouts for example sprinting or dribbling with the ball make it increasingly challenging on the aerobic system in the body (Iaia *et al.* 2009).

Positional demands within soccer attempts to analyse and understand the demands that are placed upon the different positions within soccer. This study focuses on the use of time motion analysis to examine the different positions. It is thought that different training regimes may benefit different positions (Bloomfield *et al.* 2007) and that it is worth looking at five different position categories (Bradley *et al.* 2009).

Chapter Two: Literature Review

Chapter Two: Literature Review

2.1 Introduction to Literature Review

Within sports science it is believed that the most beneficial type of training is that which most closely replicates the competitive environment of which the athlete will be competing within, therefore in soccer it may be a good idea for individuals of a specific position to follow a strict training protocol so that they are fully able to carry out their tactical requirements (Di Salvo *et al.* 2007). Soccer specific fitness tests show that highly trained soccer players are substantially fitter than recreational amateur players. Results have shown that this is especially the case when completing high intensity exercises such as sprints; these tests also show inconsistencies when measuring the fitness of amateur players (Edwards *et al.* 2003). Much research has looked into work rate at the elite end of soccer from elite leagues around the world. However there is very little work published on work rate levels in soccer at collegiate level. Because of this, specific training regimes may have difficulty being designed by coaches at this quality of soccer unless they just assume similar differences will be seen in different positions to professional soccer.

2.2 Intermittent Nature and Intensity Levels

Soccer is considered a fast moving game and it is called upon the players to have good levels of fitness. Players usually have to output short intense activities intermittently, whilst also sustaining longer periods of low-level activity for example a walk or slow jog (Reilly, 1997). Players are often requested to compete/train many months before their competitive season so that they are physically ready to compete at their respective level. Therefore if a player wants to know how to specifically train then they or their coaches should know what is required of them on average throughout the season in the games they play every week (Di Salvo *et al.* 2007).

Due to the range in ability at amateur/collegiate level soccer it wouldn't be wise to assume that players are going to be directly proportional in fitness capabilities in relation to position compared to professionals. A study conducted by Reilly (2007) found that to optimise the conditions for training programmes it is helpful to know the frequency and duration of the specific movements required. Knowledge of this will

also allow athletes to know what nutrition would be best suited for them to digest from not only match to match but in match also.

Because of the number of high intensity bouts during soccer (for example sprints or high intensity turns) it is important for athletes to develop the ability to perform intense exercise for a relatively long period of time. This can be achieved by conducting frequent sessions of an aerobic nature that best replicates the different demands of soccer, namely, physical, movement, technical and tactical demands of the game (Iaia *et al.* 2009). A disadvantage of this study is that only previous studies are used to gain the knowledge of what is required of an elite level soccer player so the research isn't conducted during the study. The results of this study do demonstrate an insight into the intermittent nature of soccer itself and how different types of training regimes can help to benefit players. Previous research has suggested knowledge of the frequency and duration of high intensity exercises could help coaches deal with the effects it may have on the different types of energy systems that are used (Di Salvo *et al.* 2007). Previous research has also suggested that fitness levels are higher in elite level performers compared to amateur level (as to be expected) however Edwards *et al.* (2003) found inconsistencies within amateur level due to the vast range in ability at this level.

Although there is little research into work rate levels at amateur level a study conducted by Mohr *et al.* (2003) found that elite level performers perform 28% more high intensity running than professionals playing at a lower standard, a further 58% more sprinting between the two levels (players were compared from the elite leagues in Europe and the less elite Danish league). Although this study demonstrates good insight into the different levels of high intensity running between the different leagues, the study fails to analyse other ways in which high bursts of energy can be used in soccer for example high intensity shuffling. This could potentially affect the validity of the results because different positions exert energy in different ways, for example central defenders spend more time running backwards than any other position (Bloomfield *et al.* 2007). Further to this Reilly (1997) found that game-related activity (e.g. dribbling) can also be counted as high-intensity activity due to an increase in heart rate due to the pressure that comes with that particular role and although this research is quite dated the physiological effects of game specific activity for example dribbling are unlikely to have changed a huge amount. It would

not be a surprise for similar statistics between amateur and elite players work-rate levels, potentially to an even greater extent, however as of yet there hasn't been a study conducted that examines this kind of data.

A system called POWER (Periods Of Work Efforts and Recoveries) was designed for Sky TV and used in a study by O'donoghue *et al.* (2005) where 226 Premier League players were analysed, on average the study showed that each high-intensity burst lasted for approximately 2.9s with a rest (on average) of 26.2s following the burst. However although this is useful for showing the intermittent nature that is present in soccer it doesn't categorise the different ways in which work and rest are used. Also players are categorized into three main categories which are Defenders, Midfielders and Strikers. This could be potentially have reliability issues because wide midfielders may work for longer than central midfielders and similarly with defenders as demonstrated in (Lago-Penas *et al.* 2009).

Although dated 16 years in the past, O'Donoghue's (1998) study again gives good examples of the intermittent nature of soccer for example 1372 movements are recorded on average per match in each position as well as this frequent high intensity bursts. This study includes 11 different movement variables compared to the 7 used in the current study which suggests more regular changes in movement are likely to be seen.

2.3 Work Rate Analysis in Soccer

Work rate in soccer is used as the way to gross measure the demands that are placed upon a participant (Catterall *et al.* 1993). There are different ways in which energy can be exerted by a soccer player for example running, heading, passing or tackling are all vital components of soccer and ways in which energy can be exerted (Stølen *et al.* 2005). The majority of actions within a game of soccer are off the ball incidents such as a defender trying to dispossess the opposition (Reilly, 2003). Although an inaccurate method of measuring distances covered was used by Reilly and Thomas (1976), it is thought that their study of work-rate analysis among the English first division (at the time of the study this was the elite league in England) was an important study that acted as a reference point for future studies. The main inaccuracy with this study is that the distance covered by the players (km) was measured using the pitch cuttings. This would almost always prove to be an

inaccurate method due to the different angles of movement by the players. However they did also state the number of different activities outputted by each individual player thought to be up to as many as 1000 in a single game, suggesting that there is a break/change in activity at approximately every 6 seconds. However this is dependent on how many movement classifications are being used within the chosen study, for example in some studies high intensity movements such as running and shuffling are merged together and therefore less movements would be recorded.

Using previously conducted research Tenga (2013) designed a table documenting distance covered and number of sprints across elite leagues in Europe. The data recorded stated an increase in total distance covered from 1954-2011, an increase in number of sprints is also recorded within the same time frame. This suggests that in order not to fall behind opposition teams conditioning of players is important and must match that of their opponents. Teams must continue to improve work-rate because it is likely that their opponents will be striving to do the same. However the table fails to include (potentially due to lack of evidence) different ways in which high intensity exercises can be outputted. Research since then has used more sophisticated methods to accommodate the different types of ways in which high energy output actions can take place for example turns and jumps, examples of this could include Bloomfield *et al.* (2004) and O'Donoghue (2008).

There have been numerous studies that use heart-rate data to determine how hard the cardiovascular system works; data suggests that strain on the cardiovascular system is high and there is a close relation between beats per minute and distance covered by an athlete (Ali and Farally, 1991; Bangsbo, 1994). A study was conducted by Van Gool et al. (1983) examining heart-rate levels at university standard soccer; again this study confirmed that during soccer matches strain was placed on the cardiovascular system. The study states that the mean beats per minute was the same for centre backs and full backs (155), midfielders having a mean of 170 and the two forward players examined had a mean of 168 and 171. Although this suggests that all players heart-rate values increase whilst participating it may be over-estimating the values because other factors have not been taken into account, these factors could include climate or mental stresses (Bangsbo and Krustrup, 2009).

2.4 Positional Demands of Soccer

In a study conducted by Bradley *et al.* (2009) it was implied that different positions consistently cover different distances on average, namely, wide midfielders ran further than central midfielders, full backs, strikers and central defenders respectively. A strength of this article is that twenty eight premier league matches are viewed which is a vast amount of games to take an average from thus ensuring that the scores will be quite reliable. However the work rate analysis results may not be entirely valid because it doesn't take into account the different ways in which energy output can be measured for example, centre backs may not cover the most ground but traditionally that is the position that is known best for heading and tackling the ball which is a big part of soccer (Stølen *et al.* 2005). Therefore if this study was to be developed further then potentially different ways in which energy can be outputted should be taken into consideration.

Due to the nature of movement in different positional rolls it is thought that different training regimes could benefit different positions. Defenders and strikers could develop from speed and agility training whereas midfielders could benefit from longer running schedules (Bloomfield *et al.* 2007). In this study the different types of ways in which energy can be exerted during a game of soccer is taken into consideration, for example it is noted that defenders spend a lot more time running backwards compared to other players. Taking this and other indicators into consideration Bloomfield *et al.* (2007) suggest that defenders and attackers could benefit from different types of training to midfielders for example a speed and agility training regime. However within this article the positions are only split up into three groups, this is something that if further research were to be conducted in this area would have to be looked at because different areas within the groups could be completely different for example full backs usually run further than centre backs in a game (Reilly, 1997).

Measuring the range in duration between high intensity and low intensity bursts in Premier League will help to understand the intermittent nature of association soccer (O'Donoghue, 2002). An impressive fifty two Premier League matches were viewed and analysed to gain the results during this study, the results suggested that like Di

Salvo *et al.* (2007) because of the difference in performance between strikers, midfielders and defenders different training regimes could be designed specifically by the coaches for their athletes for example it is stated that midfielders have substantially less recovery time than defenders and this is something that coaches could look to take into account. However similar to the study produced by Bloomfield *et al.* (2007) the different kind of positions could be broken down further because wide midfielders usually cover a greater distance than central midfielders (Bradley *et al.* 2009) so these results should be verified and studied further before different kinds of training are presented to the different positional group.

Each previous study that examines work rate analysis in professional soccer for example Rienzi *et al* (2000) finds that high intensity activities are frequent throughout. Using the results found in the present study then specific training regimes could be thought up by the coaching staff in order to benefit the players in position specific ways. The best possible way for them to achieve this would be to mimic the intermittent nature that is demanded at this level of soccer; this would include not only physical movement but technical and tactical demands also (Iaia *et al*, 2009). An example of this could be if central midfielders spend a longer time jogging than any other position like it does in professional soccer this information could be utilized whilst designing a specific training regime for example long periods of aerobic exercise could be deemed useful.

Chapter Three: Methodology

Chapter 3: Methodology

3.1 Summary of Design

The most effective way in which any one players movements can be recorded is through footage that focuses solely on that individual player. However this kind of footage is not easily available at amateur or collegiate level. So in order for time motion analysis to be conducted live observation of the game will be used. The observer would view only one player and state one of the seven movements that the player were undertaking and once a new movement had been conducted the observer would then state the new movement, this process would continue until the end of the match. The recording, once finished, was then played back and the movements were entered into a software called DOSbox that coded the data ready to be analysed.

3.2 Players

To acquire the sample of players, 20 players were viewed at amateur or collegiate level; the teams used were Cardiff Metropolitan 1st team and Cardiff Metropolitan 2nd team as well as their opponents during the 2013/2014 season. This included games from the BUCS Championships as well as the Welsh League Division three and the Welsh League Reserve Division Central.

In total 20 different players were used with five positions being selected and four players in each position being used as to gain an accurate representation of each different positions average work rate. The five different positions were; Central Defenders, Wide Defenders (full backs), Central Midfielders, Wide Midfielders and Forwards (strikers).

Players were mainly viewed at Cyncoed Campus as this is the home ground of Cardiff Metropolitan FC and predominantly where the majority of the games are played. However one of the games was viewed at Llandaf Campus (another of Cardiff Metropolitan's home grounds) and another at Llanrumney Sports Fields (Home ground of Cardiff University). Half way through the season a 3G pitch was built at Cyncoed Campus with the biggest dimensions allowed for a soccer pitch affecting the style of soccer that was played by both teams.

3.3 Data Collection

The data was collected by two independent observers verbally transmitting the different movements being performed into a dictation machine. It was decided that instead of renting/buying a dictation machine that an equally adequate way of recording verbal transmissions would be to use the already owned iPhone 5. Once recorded a back-up copy was installed on an iPad device. The movements that the observer had to transmit weren't always objectively performed which made it down to the observer to classify the movement consistently so that the end data was accurate and reliable. However this was affected by the fact that there were two observers who may have had slightly different interpretations of what movement classification was being performed.

Once the data was recorded, in real time the recording was played back and entered live into the DOSbox system. Once each individual match has finished the data was saved onto the observer's memory stick and laptop device ready for further analysis to gain the results.

As the two independent observers attended Cardiff Metropolitan University during the time of data collection this made data collection easily accessible. This also gave the observer easy access to the specific sources needed to code the data (DOSbox). DOSbox is a system to create statistics on the work rate of an individual soccer player and describe the different movement patterns that they undertake.

3.4 Important Terms

In order for the observer to have a precise idea of each movement classification research was conducted to gain an accurate definition of each classification that has been used in previous research. It was important for the coding to be accurate that the observer had a clear understanding for each classification as to remain consistent and valid. The following definitions are taken from Bloomfield's (2004) classification of movements and O'Donoghue (1998) study of time motion analysis in elite soccer.

Low-Intensity Exercises

Standing – More or less stationary staying in one spot, this includes lying or sitting down.

Walking – Moving slowly by stepping.

Backing – Similar to walking but in sideways or backwards motion.

Jogging – Moving at a slow monotonous pace (slower than running, quicker than walking).

High-Intensity Exercises

Shuffle – high intensity backwards, sideways and on the spot movement requiring significant effort

Running – Manifest purpose and effort, usually when gaining distance.

Game Related Activity – Any time in which the soccer is in possession of the selected player or is outputting energy in a game related way for example a tackle or an aerial challenge.

3.5 Reliability

One of the main issues of reliability associated with the study was the weather conditions the observer had to endure. Although shelter is provided during the playback of the recorded data it wasn't always easy for the independent observers to clarify the movement classification, this is why it was important for the observer(s) to speak clearly and precisely so that the coding process was made easier, this included abbreviating the chosen movement specifications. As well as this half of the matches analysed were played before Christmas and half of them were played after. After the Christmas period matches were played on a new artificial 3G pitch with the biggest pitch dimensions that were allowed and before Christmas matches were played on smaller grass pitches. This could have effects on the results as the two pitches may have caused different 'brands' of soccer to be played by both teams causing different levels of work-rate.

As there were two observers used it was seen as important for the study that the two observers had a good strength of agreement. In order for this to be confirmed a reliability game was arranged. Using the same process as the other matches coded it was decided that an accurate way in which to test for reliability for two independent observers was to use the kappa statistic which is a measure of reliability for nominal variables (Cohen, 1960). It was expected that human error would occur, for example a difference in timings between the two observers which would lead to instances that didn't overlap and also pressing the buttons whilst using DOSbox.

Table 3.1 *A table to show Altman's (1991) interpretation of kappa values*

Kappa (K)	**Strength of Agreement**
K ≥ 0.8	Very Good
0.6 ≤ K < 0.8	Good
0.4 ≤ K < 0.6	Moderate
0.2 ≤ K < 0.4	Fair
K < 0.2	Poor

As seen above in figure 3.1 it was important that the two observers gained a kappa value of at least 0.4 above as to agree a positive strength of agreement so that the results could be counted as reliable.

3.2 *A cross table to show the volume of time when the two independent observers recorded different activities*

Observer 1	Observer 2							
	ST	WA	BA	JO	RU	SH	GA	Total
ST	345.67	368.74	29.11	16.61	0.00	0.00	0.00	760.13
WA	103.51	1768.07	175.24	365.84	3.47	0.00	41.78	2457.91
BA	30.02	182.73	233.42	73.58	1.16	1.05	10.23	532.19
JO	41.08	384.76	118.73	967.59	24.83	4.45	123.05	1664.49
RU	5.53	9.27	12.61	28.93	6.27	1.05	13.73	77.39
SH	1.41	10.47	16.03	10.01	1.66	0.00	10.21	49.79
GA	0.14	11.58	5.92	12.83	0.18	0.53	19.19	50.37
Total	527.36	2735.62	591.06	1475.39	37.57	7.08	218.19	5592.27

Using the data collected and analysed using a spread sheet that cross-tabulated the overlapping times and the amount of times each overlap a P0 value of 0.597 was

calculated. However as there were to be times where the two observers agreed the same classification of movement by chance, again using the spread sheet a PC value of 0.317 was gathered. Finally it was decided that due to the operators starting or finishing a classification slightly differently to each other that the spreadsheet allowed for a little leeway. Eventually the spread sheet showed an end kappa value of 0.411 which, according to Figure 1. (Altman 1991) guidelines for kappa a moderate strength of agreement and therefore deemed appropriate for the study.

3.6 Attainment of Results

As the study was comparing five different categories it was decided that either a one way ANOVA test or a Kruskal Wallis H test. In order to determine which test would be more effective a Shapiro-Wilks normality test was conducted. The results can be seen in Appenix A.

The table shows that there was a significant difference to normality ($p.$ <0.05) in 11/30 the different kinds of variables. Demonstrated by the table in Appendix A there are a number of significant differences to normality for the key variables for example .024 for frequency of being stationary, .20 for the duration of walking and .14 for the duration of shuffling. With the results suggesting that there were high levels of normality it was decided that a One-Way Anova test was the most efficient way of analysing the results because difference to normality is the important aspect for this test. It also fit into the other requirements which were the results are independent (only one player was analysed per match) and each position analysed to the same standard (four players were analysed in each position).

The ANOVA tests were conducted however there were no significant differences between any pairs of positions. If this wasn't the case then potentially other tests could have taken place for example a series of Bonferroni post hoc tests could have taken place to demonstrate exactly why there were significant differences.

Finally a paired t-test was used. This test was conducted to compare the differences between the first and second half activity. The types of activities that were compared between both halves in each match included recovery time between bursts, duration of bursts and the percentage of high intensity activity.

Further to these tests, other statistical analysis took place to produce various tables and charts that demonstrate the different kinds of activities that took place between the different positions. This included various types of graphs and charts that demonstrated useful information such as the frequency and duration of different movement classifications, mean time spent doing different types of activities in each position and comparison between the first and second half.

Chapter Four: Results

Chapter 4: Results

4.1 Outline of Findings

Table 4.1 demonstrates a summary of the different movement classifications of all the players. It shows how frequently they are completed, their duration on average and the percentage of time that each classification uses. The table shows that whilst jogging is the most frequent classification (172.4±138.5) it does not take up the highest percentage of time due to the mean duration (9.8±4.0s) being less than that of walking. Walking which is measured as having a frequency of (160.7±123.1) and a mean duration of (13.4±5.9s) shows to have a percentage of time of 42.1±5.6%, approximately 10.5% higher than that of jogging (31.6±7.4%). It is clear that the high intensity activities, running, shuffling and game-related activity take up a substantially lower amount of time than that of the low intensity activities. Running and game-related activity have similar results showing a frequency of 55.5±26.7 and 53.3±11.1 respectively. Also the mean durations of both are similar (3.8±1.0s and 3.9±1.1s respectively). Shuffling measures a lower amount with the frequency measuring 30.1±21.0 and having a mean duration of 2.9±0.7s.

Table 4.1 *Movement performed by all positions.*

	Frequency	Mean Duration (s)	Percentage of time (%)
Stationary	67.8±41.1	10.7±4.2	11.3±4.5
Walking	160.7±123.1	13.4±5.9	42.1±5.6
Backing	59.6±23.3	6.6±3.2	6.2±2.1
Jogging	172.4±138.5	9.8±4.0	31.6±7.4
Running	55.5±26.7	3.8±1.0	3.5±1.3
Shuffling	30.1±21.0	2.9±0.7	1.5±1.0
Game-Related Activity	53.3±11.1	3.9±1.1	3.8±1.5

4.2 Playing Positions

Table 4.2 demonstrates (using the 20 players in the study) the average amount of times per game a specific movement classification happens in each position. Again it is clear that in each position high intensity activities are performed consistently less that of the low intensity activities in each position. It shows that defenders (centre backs (79.8±33.4) and full backs (89.8±58.5)) are more frequently stationary than either set of midfielders and the forwards. Walking however is consistent throughout the defenders and midfielders with forwards performing a walking movement on average 212 times a game approximately 47.5-70 times more often than any other position. Jogging is consistently the most performed activity in each position apart from in the full back position where the walking classification is approximately 9.2 units higher. Running is shown to be most frequently performed by the forwards who record an average of 72.5±42.4 as opposed to the full backs who only perform an average of 41.5±19.2. Oppositely to this shuffling is performed more consistently by defenders, 37.5±27.5 by the centre backs and 36.3±20.5 by the full back as opposed to the 19.8±19.5 times by the forwards. For both running and shuffling both sets of midfielders fall into the middle of the range. Central midfielders perform the highest amount of game-related activities (65.5±12.1), approximately 19.2 times more than the lowest performed by the forwards. The *p.* value for each variable was over 0.05.

Table 4.2 *Frequency of movement performed categorised by playing position*

	Frequency of movement performed						
	Stationary	Walking	Backing	Jogging	Running	Shuffling	Game
Position							
CB	79.8 ± 33.4	143.8 ± 113.7	64.8 ± 26.1	164.5 ± 128.4	52.5 ± 10.1	37.5 ± 27.5	51.5 ± 5.2
FB	89.8 ± 58.5	164.5 ± 145.8	66.3 ± 26.1	155.3 ± 154.4	41.5 ± 19.2	36.3 ± 20.5	54.3 ± 12.9
CM	58.8 ± 35.7	141.3 ± 130.8	50 ± 25.7	175 ± 167.7	55.3 ± 36.5	28.3 ± 24.6	65.5 ± 12.1
WM	48 ± 29.6	142 ± 128.6	60.5 ± 26.9	153.3 ± 134.8	55.8 ± 16.7	28.5 ± 19.0	49 ± 5.3
FW	62.5 ± 67.8	212 ± 152.5	56.3 ± 21.8	213.8 ± 177.9	72.5 ± 42.4	19.8 ± 19.5	46.3 ± 11.0
p. value	.659	.934	.892	.980	.643	.800	.111

Table 4.3 demonstrates the average duration of each movement classification in the chosen positions. Firstly it shows again that high-intensity activities last a consistently shorter amount of time. During stationary periods it is visible to see consistencies however centre backs have a longer period to be stationary compared to any other position. Forwards spend on average only 5±1.9s backing compared to the average full back who spend on average 7.6±4.8s. Central midfielders and wide midfielders spend a longer duration of time jogging on average than any other position. There are few differences in the duration between positions whilst shuffling however it does demonstrate players in wide areas (full backs and wide midfielders) have longer periods of running compared to other positions. This is also the case in game-related activity. Again the P value for each variable was over 0.05.

Table 4.3 *Duration of movement performed categorised by playing position*

	Duration (s) of movement performed						
	Stationary	Walking	Backing	Jogging	Running	Shuffling	Game
Position							
CB	12.9±6.8	13.8±6.7	6.3±3.0	8.4±1.9	3.8±1.0	3±0.6	3.8±1.2
FB	10.2±4.4	12.8±6.6	7.6±4.8	9.4±4.4	4.2±1.4	3±0.4	4.3±1.0
CM	10.3±3.4	13.5±6.7	6.5±3.7	11.0±4.9	3.7±0.9	2.8±0.4	3.6±1.1
WM	10.1±2.6	13.8±5.3	7.4±3.4	10.5±4.6	4.1±1.1	2.9±0.5	4.4±1.1
FW	10.1±4.4	13.2±7.4	5.0±1.9	9.8±5.5	3.4±3.8	2.9±1.5	3.3±1.1
p. value	.878	.999	.844	.932	.884	.997	.612

Using the percentages of time spent in each role by the different positions Figure 4.1 demonstrates a stacked bar chart that shows the percentage of a match on average each position spends performing different movement classifications. Looking at the bar chart it is easy to see that forwards spend less time performing high intensity exercises particularly game related activity (2.9). It is also clear that central midfielders spend a larger portion of the game jogging (37.1) than any other position. It's also visible to see that walking is the most common variable in each position.

Figure 4.1 *Stacked bar chart that demonstrates the percentage of the match spent in different roles by position*

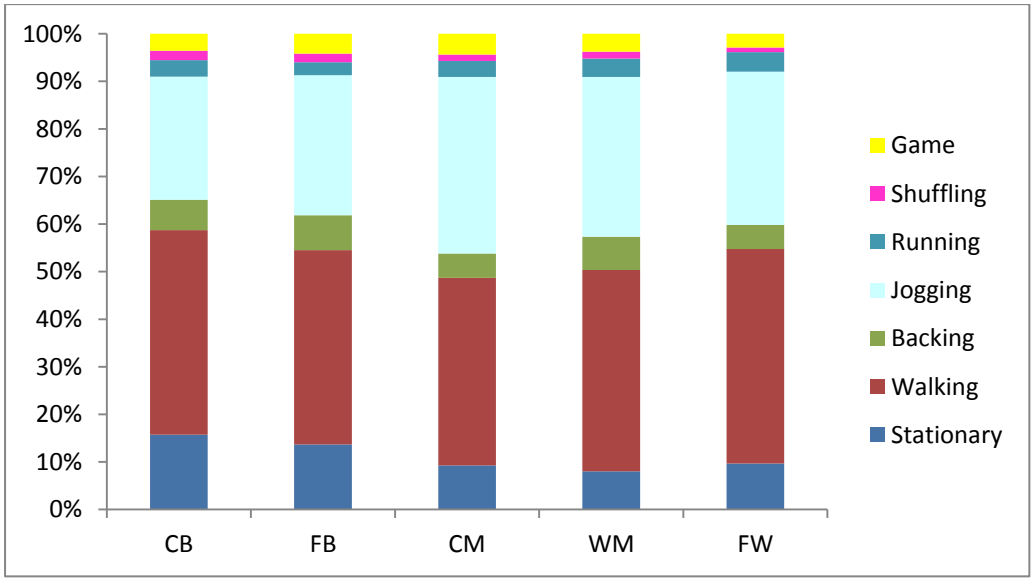

Table 4.4 shows the average frequency and duration (s) of high intensity activities performed by the five separate positions. It also demonstrates the average duration (s) that each position category gets for recovery. As well as this it also shows the frequency of 6-10s bursts and 10s+ bursts. The duration of recovery periods by central midfielders, 45.4±14.1s is less than that of any other position whereas wide players (full backs and wide midfielders) have approximately an average of five seconds longer. This fits in with the fact that wide players have a larger frequency of 10s+ bursts at 8.5±6.6 and 8±7.4 respectively compared to that of a forward (3.8±4.3).

Table 4.4 *A comparison of different playing positions in relation to different variables.*

	Playing Position					
	CB	FB	CM	WM	FW	*p.* value
Frequency High Intensity	114±30.6	107.3±29.6	120.8±37.3	108.3±30.1	116.5±37.1	.974
Duration High Intensity (s)	4.7±1.4	4.8±1.4	4.4±9.9	4.9±1.0	4.1±1.2	.846
Duration Recovery (s)	46.5±11.9	50.7±14.9	45.4±14.1	49.6±13.2	47.3±15.9	.982
Frequency 6-10s Bursts	18.3±4.9	17.5±5.4	17.3±4.9	17.3±8.2	13.3±6.2	.789
Frequency 10s+ Bursts	5.8±5.2	8.5±6.6	7±3.7	8±7.4	3.8±4.3	.763

4.3 Comparison of Halves

Figure 4.2 demonstrates how consistently positions spend more time in the first half performing high intensity activities. With one exception, wide midfielders go from 8.5±1.9 to 9.6±2.0. The biggest fall in high intensity activity between the two halves is the centre midfielders that go from 10.0±1.8 to 8.2±2.0.

Figure 4.2 *Percentage of high intensity categorised by playing position*

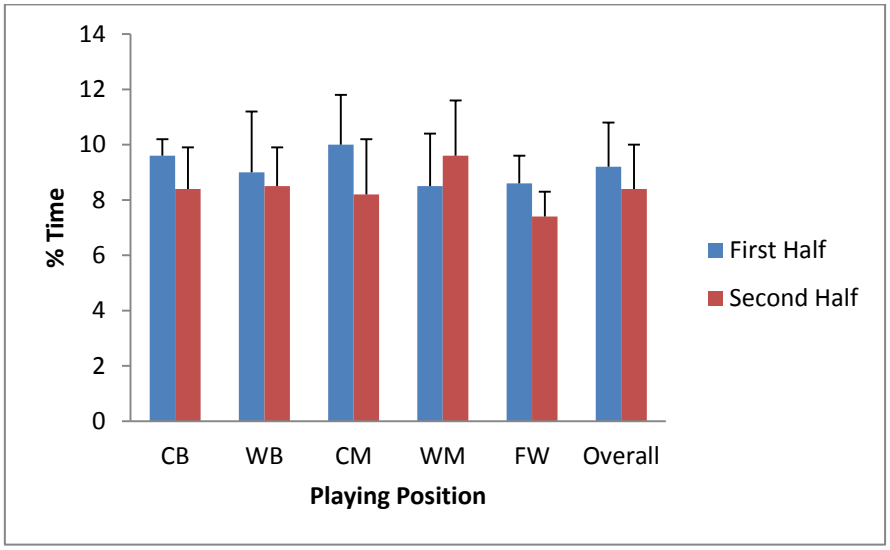

Figure 4.2 also shows the overall statistics between the two halves, again reiterating the fact that there is a drop in high intensity activity in the second half. The percentage time spent undertaking high intensity activity in the first half is 9.2±1.6 compared to the second half which is 8.4±1.6.

Chapter 5: Discussion

Chapter 5: Discussion

5.1 Intermittent Nature of Activity

Due to the nature of the computer software used (DOSbox) results produced showed how frequently activities were undertaken. The system also produced results to demonstrate the length of bursts between 6 and 10 seconds and any bursts that were 10 seconds or more. Together these results with a good indication to the nature of the intermittent activity at university level as well as the intensity levels that are needed to compete at this standard.

Referring back to table 4.4 it is shown that on average each position performs consistently over 107.3±29.6 movements with the maximum reaching 120.8±37.3 in the central midfielder position. The data also suggests that each position, in each game is performing multiple high intensity bursts of over 10 seconds and up to ten more bursts lasting 6-10 seconds.

It is easy to test for energy systems used in sports that are easily recreated in a lab environment for example running. It isn't as easy in sports such as soccer because it is hard to know what movements are carried out throughout the duration of a game. However using the knowledge of the high intensity bursts recorded in the study it is easy to see the importance of ATP-PC and glycolytic energy sources within soccer (Artioli *et al.* 2012). An example of this could be Silva *et al.* (2011) who used time motion analysis to see what drink type would be best used to serve soccer referees during competition; this sort of information could be useful if transferred to players.

The current research shows approximately an average of 120 'Purposeful movements' (running, shuffling and game-related activity). According to Bloomfield *et al.* (2007) there are 168 purposeful movements on average during a game of professional soccer. However this research has 8 different classifications of movements so it was likely that more purposeful movements (and movements in general) were going to take place throughout the game.

In a study conducted by O'Donoghue (2002), stated is the importance of finding out the range in duration between high intensity and low intensity bursts to understand the intermittent nature of soccer. O'Donoghue (1998) found the mean duration of high intensity bursts was 2.6s in elite level soccer which is far less than the average

found in the current study which is 4.6±1.1. The difference between the duration(s) levels is substantial however it does support the research conducted by Edwards *et al.* (2003) which states that fitness levels in professionals are almost certainly going to be higher than that of amateurs (or in this case university players).

The study conducted by Edwards *et al.* (2003) is further supported when the frequency of high intensity bursts is examined in comparison with premier league soccer. The mean frequency 113.4±29.9 of high intensity bursts is again substantially lower than the frequency found in premier league soccer by O'Donoghue (2005) which found a mean frequency of high intensity bursts of 174. However the way in which the data was collected was on a system called power which only analysed data using a button for low-intensity activity and a button for high-intensity activity. Although this doesn't give much scope for how energy is exerted it is still a good indication of the intermittent nature of soccer.

5.2 Intensity Levels of Activities

Work rate is seen as the optimum way in which statistics can be recorded to test what demands can be placed upon a participant (Catterall et al. 1993). It is important when analysing work rate levels in soccer to remember the different ways in which energy can be exerted for example game-related activity or a shuffling motion (Stølen *et al.* 2005). Observers must take into account of the energy cost of moving at the range of speeds is elevated when a player is in possession of the ball (Reilly and Ball, 1984).

The present study shows that the mean time spent performing high intensity activity by all players overall is 8.8% which is recorded as 3.3% lower than that recorded in O'Donoghue's (1998) study. This isn't surprising given what was found in the previous section of a mean lower frequency rate as well as a lower duration(s) of activity. However this statement cannot be seen as 100% reliable as the compared study is dated 16 years ago and soccer may have developed since then at an elite standard although there is no evidence to support this it has been suggested in a study by Bradley *et al.* (2009) that soccer has increased in tempo over the years.

In a study conducted by Carling and Dupont (2011) they found that there wasn't a large amount of high-intensity running and in-line with most other findings the

majority of the time was spent at a ‘light’ intensity. The current research shows that from the low-intensity energy outputs during soccer that walking and jogging are the most used movement type (similar to that of professional players). Similar to this is the high intensity output classifications Bloomfield *et al*. (2007) again found that similar to the current study that the main source for high energy output is running however there are different classifications in this study that include sprinting and running as different categories, this is something that could be altered in order to take a closer look between how energy is spent during soccer in comparison with that of a collegiate standard.

In comparison with Mohr *et al’s* (2003) study it is clear to see that professionals perform a higher number of high intensity bursts but for usually a lesser amount of time. The players performing at a collegiate level of soccer on average perform a higher number of 10s+ bursts. This implies that professional players use their energy more efficiently and select appropriate times to output high intensity bursts without needing to have them last longer than ten seconds. This could be down to natural good positioning or enhanced ability due to regular and high quality training. This is supported by the study conducted by O’Donoghue *et al* (2005) who utilizes a software called POWER for time motion analysis in Premier League soccer. The study finds a rest time between high intensity bursts at an average of 26.2s. Results found in the present study find a rest time of almost double that (ranging from 45.4±14.1 to 50.7±14.9) as well as this, it further supports the statement that players at a collegiate level perform more 10s+ bursts. The ATP-PC energy system tends to allow approximately 12 seconds of maximum effort (Artioli *et al.* 2012). This implies that players at collegiate level often go for the maximum time their body lets them and could explain why they often have a longer recovery period than professionals. If coaches could add a greater structure to their formation and not allow players to exert energy needlessly then they could potentially have a greater use of energy than that of their opponents.

In a study conducted by Sampaio *et al.* (2005) it is stated that in professional football recovery time is vital if they are going to be outputting multiple high intensity bursts throughout the game. Based on the research that has already been carried out through this study this further supports the theory that players at this level should try and restrict the amount of times that they output a high intensity burst of over 10s in

order to try and reduce their recovery time and have the ability to output higher frequency of high intensity activities.

The current study shows that the average duration(s) spent ‘stationary’ is very consistent. This could be due to the stoppages in play seen at amateur football compared to professional. Amateur players often have to get the balls themselves and this allows players stoppages in play whenever the ball leaves the pitch by a long distance. Oppositely to this professional standard soccer games have ‘ball boys’ and the play is rarely (if ever) stopped during the duration of a game due to the ball being off the pitch.

5.3 Positional Role Analysis

Whilst examining work rates in the different positions it is important account for the different ways in which energy can be exerted this is something that Bradley *et al.* (2009) fails to account for. However unlike other articles for example Bloomfield *et* al.’s (2007) study the article does account for the five different position classifications, namely, full backs, centre backs, wide midfielders, central midfielders and forwards. In light of this the current study takes into account both of these aspects in order to gain the most reliable results.

The current research finds that forwards are the players that most frequently sprint (72.5±42.4), substantially more than any other position. However data taken from a study by Di Salvo et al. (2010) suggests that wide midfielders partake in more sprints than any other position. This could give the impression of wasted energy by forwards at collegiate level and they might be best only sprinting when they have a greater chance of gaining possession or scoring goal.

The theory that different training regimes could be utilized in different positions is supported by Bloomfield *et al.* (2007) who states that forwards and defenders could benefit from a speed and agility training regime whilst midfielders could potentially benefit further from interval training as they spend a longer percentage of time jogging and have a lesser recovery time. These results however don’t entirely link in with the results of the current study; the results of the 2007 are only split up into defenders, midfielders and forwards. The results of the current study find that like midfielders in Bloomfield et al.’s (2007) study central midfielders have a shorter

recovery than that of any other position. However the results don't appear to be substantial enough to base a training regime around because the maximum amount of lesser recovery time central midfielders have as opposed to other positions ranges only from 1.9-5.3s. Because the results of the study are only split up into three groups the current study doesn't support the theory that all midfielders could benefit more than others from interval training. This is because central midfielders and wide midfielders have very different results that suggest that wide midfielders have a similar energy output to that of full backs which questions the validity of categorizing positions into just three categories. However the current research does support the statement from (Bloomfield *et al.* 2007) that forwards could benefit from speed and agility training because they do frequently undertake running movements more than any other position and have a longer recovery time so it could be said that forwards don't have to have substantial fitness levels compared to midfielders.

Central midfielders undertake game related activity more often than every position (65.5±12.1) whilst still having the second shortest duration whilst undertaking a game related activity (3.6±1.1) seconds. Using this information central midfield players could adapt to this in training potentially by playing small sided games as this could mimic game related activity, speeding up the rate of which they pass/shoot the ball and provide valuable interval training (Aguiar *et al.* 2013).

Each positional role has unsurprising similarities as like many other time motion analysis studies of soccer players tend to spend the majority of the game undertaking low intensity exercise. Similar results are seen in the current study with the participants spending the majority of the time either walking or jogging (totalling a range of 39.4±5.3 to 45.1±6.5 walking and 25.9±9.7 to 37.1±6.1 jogging). This is probably due to the recovery period required due the frequent bursts of high intensity exercise (Mohr et al. 2003).

According to Bloomfield et al (2007) centre backs spend the most time moving backwards and similar results are seen in this study as they also spend the most time 'backing' this isn't surprising at is often in the nature of a defenders work to spend time backing from goal kicks and marking forwards. The fact that centre backs undertake a high percentage of high intensity activities whilst still having a low percentage of high intensity running compared to other positions (Bloomfield et al.

2007) could be explained by the nature in which they output energy. As research has showed that they are involved more often in heading and tackling this would also explain why the duration(s) of each movement by a centre back is a mean of 3.8±1.2s which is shorter than that of wide players.

5.4 The Difference in Halves

The majority of time motion analysis soccer studies include a comparison between the first and second halves of a match. Almost all of the studies examined found a decrease in work rate from the first half to the second half (O'Donoghue, 1998 and O'Donoghue *et al.* 2005). With an overall drop in high intensity activity from 9.2±1.6 to 8.4±1.6 the current study matches other professional soccer studies in the fact that players have a drop in high intensity activity output from the first half to the second half. The most probable reason for this drop in energy output is due to fatigue. Artioli *et al.* (2012) suggest that bursts of high intensity activity over 10s can lead to fatigue quicker than more frequent shorter bursts, this could potentially be a reason for the fatigue at this level.

Referring back to figure 4.2 it is easy to see in most circumstances a substantial drop in high intensity output in each of the different positions with the highest drop coming from central midfielders as they drop from 10.0±1.8 to 8.2±2.0. This is unsurprising as they output high intensity energy most frequently and spend the highest percentage of time outputting high intensity activity. Interestingly opposing all other positions there is an increase in high intensity output from wide midfielders (8.5±1.9 to 9.6±2.0) this could be due to a number of reasons. A potential reason could be to their involvement in the game, as players become fatigued passes could be played into the wide areas and wide midfielders become more involved in the game. This could cause a greater number of substitutions in this area and research shows that the percentage of high intensity bouts in midfield substitutes is superior to that of players that started the game.

Firstly Castellano et al. (2011) cites that a cause for a drop in distance covered and high intensity bouts could be due to fatigue of players. Secondly another variable that was cited as potential causes for a drop in work-rate between halves were match status, for example if a team is winning comfortably they may ease off an begin to dictate the tempo of a game, similar to this they could be losing substantially

and simply stop trying. They also suggest that match location could have an effect (home vs away) however this isn't the case in the current study as two observers used and the same games were viewed there were always one player from either team being analysed. The final variable stated in the study was the quality of opponent, it is thought that teams at opposite ends of the table with have different physical abilities and also different teams may use different tactics and adopt different styles of play. Further to this, one variable that may be independent to the current study could be the change in pitch half way through the season due to the pitch being larger in size and the better quality of turf teams may have adopted different tactics and styles of play which could have an effect on intensity levels throughout the games.

Carling *et al.* (2010) suggest that when forwards enter as a substitution they don't utilize their full physical potential whilst when midfield players get substituted onto the pitch they're work rate levels were noticeably higher. Due to the percentage time performing high intensity activity in the first and the drop in the second half (10.0±1.8 to 8.2±2.0) from central midfielders this data shows that they are the most fatigued player. The information from the current study combined with that of Carling *et al.* (2010) suggest that if a coach was going to make a substitution for fatigue reasons as opposed to tactical reasons that the most efficient substitution to make would be that of a central midfield player.

It isn't surprising that results of this study see similar results to other studies in relation to the decrease in high intensity activity as the duration of the game goes on. This is probably due to the fatigue element that is married with the intermittent nature of soccer. The study by Bradley et al. (2009) supports this theory; they found that each time athletes have a substantial period of high intensity they suffer from a shorter form of fatigue however this takes its toll on players as towards the end of the game an easily visible longer form of fatigue sets in as high intensity bouts markedly decrease.

Chapter Six: Conclusion

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6.1 General Findings

In conclusion, it can be stated that work-rate analysis is a key part of intermittent sport and especially soccer. It can also be said that collegiate level soccer has similarities and differences to that of professional soccer. Significant differences were found between all five of the different positions.

Once the data had been collected and a Shapiro-Wilkes test had been conducted, there were several significant differences to normality (11/30) between the different variables that effect positional demands on a player. This lead to a one way ANOVA test being placed upon the statistics that had been found so that comparisons could be made between the different variables/positions.

The results found that similar to previous research, activity output at professional standard was similar to collegiate level as it was highly intermittent. However at collegiate standard it appeared that players often outputted more frequent 10s+ bursts than professional players. This research, similar to research that analyses professional soccer, suggests that there is a significant drop in percentage time spent outputting high intensity in the second half opposed to the first half. However unlike other studies this study finds an increase in high intensity percentage output from wide midfielders; however the study didn't find a most probable cause for this.

The results demonstrate the frequency and duration output of each of the seven movement classifications in each position. Similar to other studies, it again found that at this level of soccer central midfielders spend a large percentage of the game jogging. It also shows that due to the high intensity of a central midfielders work load that they have the biggest drop in high intensity output from the first half to second half.

6.2 Uses of Findings

Using the findings that have been produced as a result of the study coaches could be inclined to design training regimes specific to a certain position. For example it could be suggested that central midfield players could benefit from small sided games as it has a range of different benefits for this position whilst forwards could

benefit from speed and agility programmes as they are frequently involved in high intensity running.

Managers of the teams could also analyse the fitness of their players at collegiate level and using the frequencies/durations recorded during this study select the player they think could best fit the positional demands, these decisions, of course would have to fit in with the technical requirements of that particular position. It is also suggested within the study that to have the most efficient benefit on fatigue of players is to substitute the central midfield players as they are the players that are often the most fatigued and also the players replace the substituted player have a high intensity output for the rest of the game.

Finally one of the main findings of this study is the high intensity output of 10s+ by players; this is something that coaches could look to bring down. Outputting this much energy frequently has negative effects on the energy systems required for soccer and forces players at this level to have a substantially higher recovery period compared to that of professional players.

6.3 Recommendations for Future Research

The conclusions of this study could be utilized in numerous different ways at collegiate or amateur level. Building on the current research further studies could strengthen the reliability of the findings as well as give opportunities for further enhancements to be made at this level. There is still limited research into work rate levels at this standard of soccer and future studies could compare and contrast work rate levels across different areas of the UK as well as going abroad where it is likely that differences will be found as it is at a professional standard. Styles of play abroad could affect the variables differently and in each position could have very different duties opposed to the ones in the UK. However it wouldn't be recommended that amateur levels are examined to closely at a standard lower than that of the current study as a vast range would probably be found and due to this the results may not be applicable.

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Appendices

Appendix A

Appendix A - A Table to demonstrate the Shapiro-Wilks Normality Test.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
pc_hi1	.120	20	.200*	.966	20	.663
pc_hi2	.172	20	.123	.900	20	.041
f_stat	.184	20	.073	.887	20	.024
f_walk	.219	20	.013	.878	20	.016
f_back	.127	20	.200*	.940	20	.235
f_jog	.222	20	.011	.831	20	.003
f_run	.189	20	.060	.920	20	.101
f_shuf	.198	20	.038	.899	20	.039
f_game	.167	20	.147	.961	20	.560
d_stat	.118	20	.200*	.915	20	.079
d_walk	.203	20	.031	.883	20	.020
d_back	.202	20	.031	.864	20	.009
d_jog	.177	20	.102	.886	20	.022
d_run	.194	20	.046	.906	20	.054
d_shuf	.177	20	.102	.875	20	.014
d_game	.107	20	.200*	.969	20	.739
f_tot	.195	20	.045	.873	20	.013
d_tot	.123	20	.200*	.954	20	.432
pc_stat	.117	20	.200*	.950	20	.360
pc_walk	.124	20	.200*	.963	20	.607
pc_back	.101	20	.200*	.954	20	.435
pc_jog	.122	20	.200*	.952	20	.405
pc_run	.117	20	.200*	.948	20	.343
pc_shuf	.169	20	.138	.921	20	.104
pc_game	.146	20	.200*	.925	20	.122
pc_hi	.159	20	.200*	.956	20	.467
f_hi	.180	20	.087	.899	20	.039
dur_hi	.191	20	.055	.936	20	.205
dur_rec	.139	20	.200*	.938	20	.223
hi6_10	.133	20	.200*	.980	20	.931
hi10plus	.170	20	.133	.920	20	.099

Appendix B

Appendix B – A List of the Matches Analysed

Home Team	Score	Away Team	Date
Cardiff Uni 1st	2-1	CardiffMet 2nd	13/11/2013
CardiffMet 1st	6-1	Haverfordwest FC 1st	16/11/2013
CardiffMet 2nd	3-6	Bath Uni 2nd	20/11/2013
CardiffMet 2nd	7-1	Bath Spa 1st	27/11/2013
CardiffMet 2nd	2-1	Penybont FC 2nd	30/11/2013
CardiffMet 1st	8-0	Treowen Stars FC 1st	18/01/2014
CardiffMet 2nd	0-2	Bristol Uni 1st	22/01/2014
CardiffMet 1st	4-0	Swansea Uni 1st	29/01/2014
CardiffMet 1st	0-1	Marjon's Uni 1st	05/02/2014
CardiffMet 3rd	0-3	Bristol Uni 1st	12/02/2014
Game for Reliability			
CardiffMet 2nd	0-0	Bristol Uni 1st	26/02/2014

Appendix C

Appendix C – Cardiff Metropolitan University Application for Ethical Approval

When undertaking a research or enterprise project, Cardiff Met staff and students are obliged to complete this form in order that the ethics implications of that project may be considered.

If the project requires ethics approval from an external agency such as the NHS or MoD, you will not need to seek additional ethics approval from Cardiff Met. You should however complete Part One of this form and attach a copy of your NHS application in order that your School is aware of the project.

The document ***Guidelines for obtaining ethics approval*** will help you complete this form. It is available from the Cardiff Met website.

Once you have completed the form, sign the declaration and forward to your School Research Ethics Committee.

PLEASE NOTE:
Participant recruitment or data collection must not commence until ethics approval has been obtained.

PART ONE

Name of applicant:	David Jenkins
Supervisor (if student project):	Peter O'Donoghue
School:	School of Sport
Student number (if applicable):	20007691
Programme enrolled on (if applicable):	Sports Coaching
Project Title:	Work Rate Analysis Examining Positional Demands in University Soccer
Expected Start Date:	22/09/2013
Approximate Duration:	8 months
Funding Body (if applicable):	N/A
Other researcher(s) working on the project:	N/A
Will the study involve NHS patients or staff?	No
Will the study involve taking samples of human origin from participants?	No

In no more than 150 words, give a non technical summary of the project

After gaining permission from the players I will be filming them and comparing the different levels of work between different positions in a game of football. I will do this using methods of performance analysis learnt during my time at university. After gaining the results, I will analyze the results to see which position in football has higher work rates; analyzing different ways in which work rate is used in the different positions, i.e. jumping for headers or slide tackles.

Does your project fall entirely within one of the following categories:	
Paper based, involving only documents in the public domain	No
Laboratory based, not involving human participants or human tissue samples	No
Practice based not involving human participants (eg curatorial, practice audit)	No
Compulsory projects in professional practice (eg Initial Teacher Education)	No
If you have answered YES to any of these questions, no further information regarding your project is required. If you have answered NO to all of these questions, you must complete Part 2 of this form	

DECLARATION: **I confirm that this project conforms with the Cardiff Met Research Governance Framework**	
Signature of the applicant: David Jenkins	Date: 20/10/2013
FOR STUDENT PROJECTS ONLY	
Name of supervisor: Peter O'Donoghue	Date: 25/04/2013
Signature of supervisor:	

Research Ethics Committee use only	
Decision reached:	Project approved ☑ Project approved in principle ☐ Decision deferred ☐ Project not approved ☐ Project rejected ☐
Project reference number: 13/05/178U	
Name: Peter O'Donoghue	Date: 31/10/2013

Signature:

Details of any conditions upon which approval is dependant:
Click here to enter text.