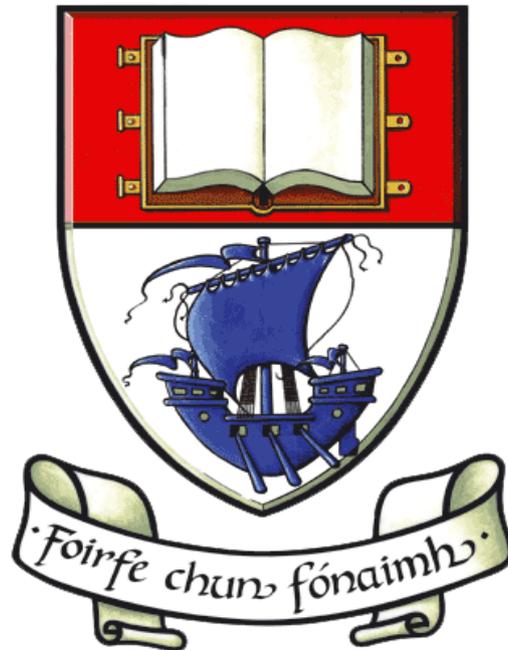


The Differentiation of Performance Variables between Successful and  
Unsuccessful Teams in Scottish Professional Football



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This project has been submitted in partial fulfilment of the Bachelor of Science  
(Honours) Degree in Sports Coaching and Performance.

**Department of Health, Sport and Exercise Science**

***BSc in Sports Coaching and Performance***

*Statement of Originality and Ownership of work*

Name: .....

Student Number: .....

I can confirm that all of the work submitted in this project is my own work, not copied from any other person's work (published or unpublished) and that it has not previously been submitted from assessment on any other course, in any other institution.

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Date: .....

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## *Abstract*

Media, coaches and supporters categorise a football performance by a team's final position in the league table. In recent times, research has suggested possession, shots and goals scored are vital in football teams becoming successful. There is a lack of research promoting other performance variables that may influence successful performances. The aim of this study was to investigate attacking performance variables that separate the top three teams in the Scottish Premier League with the bottom three teams. The match related variables were selected using modernised definitions. The match related variables analysed were crosses, dribbles, passes (forward, side/backwards, long and penetrative) and shots (inside the box, outside the box, on target, off target and effectiveness). In-match actions from 198 matches from the 2017/2018 Scottish Premier League season were tagged using analysis software. A Shapiro Wilk test was used to test the normality of the data. The data not normally distributed was analysed using a Mann-Whitney U test, while an independent sample t-test were performed on the normally distributed data. The results showed that the successful teams had significantly greater values: dribbles ( $p < 0.001$ ), shots inside the box ( $p < 0.001$ ), shots outside the box ( $p < 0.001$ ), and shots on target ( $p < 0.001$ ), forward passes ( $p < 0.001$ ), side/backwards passes ( $p < 0.001$ ) and penetrative passes ( $p < 0.001$ ). Unsuccessful teams had significantly more long pass ( $p < 0.001$ ) while there was no difference found in crosses ( $p = 0.721$ ) between successful and unsuccessful teams. The findings indicate that for teams to be successful in the Scottish Premier League, they should adopt a shorter passing, possession based style of play with the objective of creating shooting chances from within the box.

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## **1.0 Introduction**

### **1.1 Introduction**

No matter what level of competition, every team's objective is to outscore their opposition and be successful in football (Smith, Callaway & Broomfield, 2013). The purpose of this research is to identify statistical differences in attacking variables between successful and unsuccessful teams in professional football using the performance analysis approach. Performance analysis is concerned with the assessment of performances in the exact sporting environment, on the training and or game environments rather than laboratory testing (O'Donoghue, 2010). Performance analysis has frequently been questioned regarding the lack of definition and methodical severity. Conversely, in the last ten years analysis has been recognised as a sub-discipline of sports and exercise science and the variety of its uses are facilitating its growth within football (O'Donoghue, 2015; Lago-Ballesteros et al., 2010; Hughes & Bartlett, 2008). In performance analysis, the primary area of research is the study of outcomes, by evaluating Key Performance Indicators (KPI) relating to successful performances (Liu, Gomez, Lago-Peñas & Sampaio, 2015; Lago-Peñas, Lago-Ballesteros, Dellal, & Gómez, 2010; Armatas, Yiannakos, Papadopoulou & Skoufas 2009; Oberstone, 2009; Lago-Penas & Martin, 2007). KPIs can be examined from a player or overall team perspective, providing the coach with a measured unit of performance that can be analysed in comparison to data collected prior to that performance (Carling & Court, 2013; Carling, Reilly & Williams, 2009). Performance analysts examine positive and negative elements of attacking and defending events allowing an evaluation of the team's performance (Rowlinson & O'Donoghue, 2009). While comprehensive and multi-disciplinary, the primary focus of performance analysis is providing a support system to coaches aiding their judgements and coaching decisions (Glazier, 2010). Robins and Hughes (2015) defined performance analysis as a four-phase procedure; collecting, collating, interpreting and finally distributing objective information to improve the feedback procedure. This study will examine attacking variables (goals, shots, different types of passing, crosses & dribbles) successful and unsuccessful teams in the Scottish Premier League 2017/2018 season. This is determined based on their final league position, successful teams are the teams that finished in the top three that season while unsuccessful teams are those that finished in the bottom three in that season. The performance variables will be defined as successful or unsuccessful based on their outcome.

Unlike previous research, this study will dissect the passing variable into more detailed actions (Araya & Larkin, 2013; Rampinini et al., 2009; Oberstone, 2009).

## **2.0 Literature Review**

### **2.1 Performance Analysis**

Performance analysis presently implements a quantitative operational method on recording the frequency of events and patterns of players' movements (Travassos, Davids, Araújo & Esteves, 2013). Performance analysis in football was first recognised when Reep and Benjamin (1968) investigated variables of the English league and World Cup competitions. Furthermore, performance analysis research has developed over the past 20 years with many academic studies suggesting "possession play" may be a more effective approach than "direct play" (Lago-Peñas, Lago-Ballesteros & Rey, 2011). Goal efficiency is regarded as an important performance variable; in contrast, some recent literature favours the "direct play" because it has a higher goal efficiency compared to "possession play" (Yue, Broich & Mester, 2014). Direct play is a style of that aims to quickly get the ball closer to the opposition's goal with longer ranged passing. Earlier studies support Reep and Benjamin (1968) findings of "direct play" have a positive relationship with success (Bate, 1988). Recent research illustrates that successful teams' complete more short passes and consume a greater percentage of ball possession compared to unsuccessful teams (Almeida, 2018; Araya & Larkin, 2013; Oberstone, 2009). These findings may indicate an evolution of football over time. In modern football, performance analysis is used to evaluate numerous factors of a performance including individual movement patterns, actions and technique, as well as tactics and player exchanges (Clemente, 2012). Similarly, an earlier study suggests analysing a performance can be broken down into five approaches; tactical evaluation, technical assessment, movement analysis, database modelling and lastly for educating coaches and players (Hughes & Bartlett, 2008). Tactical evaluation contains developing an approach to maximize a team's strengths while concurrently limiting flaws and in-game patterns intended to complement their approach (O'Donoghue 2010). To successfully assess tactics, post-match analysis would be used to specifically concentrate on Key Performance Indicators (KPI) (Lago-Peñas, Lago-Ballesteros, Dellal and Gómez, 2010).

The massive attention and commercialism towards football has transformed the elite sport into a result centred industry (Gammelsæter & Jakobsen, 2008). With huge importance of success within football, performance analysis software has become more instrumental in providing consistent evaluations of a team's performance and accurate preparation to incorporate strategies (Atkinson & Nevill, 2001; James, 2006). In over a decade, the frequency of goals scored per game has decreased across world football (Lanham, 2005). O'Donoghue (2010) specified performance analysis helps gain an understanding of the opposition within the sport based on observation and measurement to develop strategies that can improve performances. The progression in analysis technology and equipment has enabled coaches to have a more in-depth examination of performances. Developing more effective defending tactics might be a major contributing factor of the low frequency of goals scored. Tenga, Holme, Ronglan, and Bahr (2010) demonstrated during their study on Norway's professional football league that a team's performance is affected by various tactics, echoing their importance within the sport. Oberstone (2009) referred to the correlation between final league positions and goals conceded, with unsuccessful clubs conceding a greater amount of goals in comparison to the successful clubs during the 2007/2008 season in England's top professional league. Numerous studies have been carried out to identify technical indicators that impact on successful performances. Hughes et al. (2012) looked at identifying different performance indicators per position in football. These performance indicators were similar for each position and only differentiated in order of significance. The order of significance was selected by fifteen experienced performance analysts. Arguably, the order of performance indicators may differ from coach to coach based on their style of play preference. Hughes et al. (2012) constructed a similar methodology used in earlier studies within other field sports (James, Mellalieu & Jones, 2005).

## **2.2 Key Performance Indicators**

Successful and unsuccessful teams are categorised based on their final league position (Rampinini et al., 2009). Many studies have examined performance indicators of successful teams. Findings show shots and goals scored are decisive factors of a successful team but evidently football consists of low goal scoring frequencies (Lago-Ballesteros & Lago-Peñas, 2010; Lago & Martin, 2007; Jones, James Mellalieu, 2004). Lago-Peñas, Lago-Ballesteros, Dellal and Gómez (2010) add that crosses for and against were key factors of successful and unsuccessful teams. An earlier study by Carling, Reilly and Williams (2009) proposed that only crosses into critical scoring areas should be included as key performance indicators

(KPI). The critical scoring area might be a subjective and inaccurate measurement in further research, based on the disparity of author's definitions throughout the research. Mara, Wheeler and Lyons (2012) study on tactics within women's football found that 24% of all the goals scored were outcomes of crosses from wide areas. Mara, Wheeler and Lyons (2012) methods' did not include a critical scoring zone and crosses were recorded if the action was performed from a wide position. This highlights the disparity between authors' definitions of variables.

Evangelos, Gioldasis, Ioannis, and Georgia (2018) illustrated on average,  $1.83 \pm 0.52$  goals were scored per game across Europe's top professional leagues. Lago-Penas et al. (2010) identified that successful teams in Spanish football have a greater quantity of shots at goal but also their shot effectiveness (goal conversion per shots attempted) was greater than unsuccessful teams. Similarly, those findings were replicated in studies on the English, German and Greek top professional leagues (Araya, & Larkin, 2013; Oberstone, 2009; Armatas, Yiannakos, Papadopoulou, & Skoufas, 2009). Although Yue, Broich, and Mester's (2014) definition of shot effectiveness was exact, the authors referred to the term goal efficiency. The study stated that goal efficiency was the most important team variable for a successful result, concluding that "the quality of shots is more important than the quantity of shots for winning a football match" (Yue, Broich, & Mester, 2014). Furthermore, it was reported that 85.1% of the converted shots were scored from inside the penalty area in the English Premier League (Durlik, & Bieniek, 2014). An earlier study by Yiannakos & Armatas (2006) found that 76.6% of goals were scored from inside the penalty area during the 2004 European Championships. In later competitions, the percentage of goals scored inside the penalty area had increased from 82.07% in 2010 to 92.2% in 2012 (Simiyu, 2013; Michailidis, Michailidis & Primpa, 2013). The research implies the more shots a team has within the penalty area increases the likelihood of scoring a goal. However, those figures were calculated on International Association Football and may not entirely reflect domestic league competitions due to the unique format of international competitions. Liu, Gomez, Lago-Peñas and Sampaio (2015) support the earlier research indicating that shots from within the box correlates with the probability of winning a match. The authors' also highlighted that short passes and ball possession signifies a positive link while alluding to the negative relationship that blocked shots has towards a winning outcome. In addition, Almeida (2018) stated the quality of creativity towards goal-scoring chances in the final third of the pitch to be a key factor to successful performances in professional football. The author also linked

yellow and red cards to variables aiding an unsuccessful performance. Papahristodoulou's (2008) study on the UEFA Champions League emphasised the importance of shots taken and ball possession when attacking but also highlighted the significance of shots conceded and shots on target conceded are vital when focusing on defensive variables. Furthermore, Castellano, Casamichana & Lago (2012) did not primarily focus on defensive variables but the study did conclude that shots on target conceded only difference between successful and unsuccessful teams. Earlier research does not simulate Almeida (2018) statement that red and yellow cards received are related to an unsuccessful performance (Lago-Ballesteros, & Lago-Peñas, 2010; Lago-Peñas et al., 2010; Oberstone. 2009). With the contradicting reports and lack of clarity regarding the importance of defensive variable, this highlights the limitations within the current research. The impact of defensive variables on performances is limited throughout the literature, the research predominantly analyses attacking variables.

### **2.3 Passing Variables**

Yue, Broich and Mester (2014) outlined that the quantity of shots was second regarding the order of importance followed by the total number of passes in third in achieving a successful performance. Passing is frequently analysed as a performance indicator. Barnes, Archer, Bush, Hogg, and Bradley (2014) identified a steady increase in passing averages since 2006 in the English Premier League. The findings may suggest an evolution of technical parameters within football by illustrating the significant increase in averages over a period of six seasons. The key finding in the literature showed successful teams have significantly more short passes than unsuccessful teams (Araya & Larkin, 2013; Oberstone, 2009; Rampinini et al., 2009). The studies illustrated successful teams have higher pass completion percentages. Rampinini et al. (2009) found a significant differentiation between the two group's pass completion percentages. Consequently, the vast difference may be a result of the author's definition of passes. Rampinini et al. (2009) definition of a long foot pass is any pass over a distance greater than 37 metres performed by a player in comparison with Araya & Larkins (2013) definition that a long pass is any pass over a 10 metre distance. A more recent study looked at the English Premier league, breakdown passing to three events; short, medium and long (Barnes, Archer, Bush, Hogg & Bradley, 2014). Although the different studies are looking to answer similar questions, this highlights the disparity within the literature regarding the definitions of performance variables.

None of the previous research examined the performance indicators in more detail. To investigate the indistinctness surrounding this research, the proposed study will have a more detailed look into the selected performance indicators. The process of defining the indicators will be agreed upon by the author and multiple experienced performance analysts. Research by Lago-Peñas, Lago-Ballesteros, Alexandre Dellal and Gómez (2010) discriminated the winning teams from drawing and losing teams using performance variables. The methodology was then replicated in a later study (Lago-Peñas, Lago-Ballesteros & Rey, 2011). Castellano, Casamichana and Lago (2012) identified two defensive indicators over three World Cups that differed between a winning team and a losing team; total shots conceded and shots on target received. The authors also recognised that winning teams scored more goals per game ( $2.2 \pm 1.2$ ) that resulted from the significant difference in shots on target ( $7.12 \pm 2.6$ ) compared to losing teams ( $0.4 \pm 0.6$ ). Lago-Ballesteros and Lago-Peñas (2012) illustrated that successful teams have a greater percentage of ball possession than unsuccessful teams. The authors suggested that when teams are winning, they are likely to have less possession of the ball compared to teams that are losing or drawing, consequently accumulating pressure on their defence.

#### **2.4 Limitations Within The Research**

There is a vast differentiation of description throughout the literature. The definitions of performance variables differ from study to study, with some definitions not being specific to the outcome. Araya and Larkin (2013) study in the English Premier League defined a short pass is any pass less than 10 metres while Rampinini et al. (2009) description of a long pass suggests that a 36 metre pass would be viewed as a short pass. This overestimates the distance of short range passing and such distance would be argued against within the literature. This highlights the importance of clarity regarding the terminology used to define performance variables.

There is minimal research exclusively examining defensive variables with the prime focus of studies analysing attacking variables underlining a limitation within the research. The majority of attacking literature has been published on major Association Football competitions; European Championships and FIFA World Cups (Evangelos, Gioldasis, Ioannis & Georgia, 2018; Michailidis, Michailidis & Primpa, 2013; Lago 2009; Scouling, James & Taylor, 2004). In a study by Delgado et al. (2013) on the 2010 World Cup,

successful teams were superior to unsuccessful teams in all the variables examined relating to defending. In addition, the group stage and knockout stage did not show any difference in attacking variables, indicating successful teams could maintain their attacking quality despite in theory, facing opponents of greater quality. Football Association tournament structures do not resemble domestic or league format which do not account for aspects that may considerably affect a team's performance such as quality of opponents and the quantity of matches. The results might present inaccurate data from competition to competition as the opponents can have a major impact on performance and define the success of a team by the amount of games they could play (Carling et al., 2005; Tucker, Mellalieu, James & Taylor, 2005).

Performance analysis concentrating entirely on positive and negative performance variables of football is frequently unreliable as they lack the ability to considering player exchanges and only concentrate on the outcome (Lames & McGarry, 2007; Carling et al., 2005). Gerisch and Reichelt (1993) examined successful and unsuccessful results of one-on-one situations in football. The author's methodology did not consider the performance of the athlete, only the outcome which potentially provides an inaccurate evaluation. Furthermore, the analysed performance should primarily focus on the result but in conjunction with a combination of factors that relate to the result.

## **2.5 Rationale**

As previously demonstrated, successful teams have a greater frequency and effectiveness when shooting at goal and passing. While the research states those performance variables are important in successful teams, more research is needed to identify more decisive in-game variables. The objective of this study is to identify the differentiations of performance variables between the top three and bottom three teams in the Scottish Premier League. Research by Ramchandi (2012) found that Scottish football is the least competitive when compared with Europe's top professional football leagues. Those findings might be an indication as to why there is a lack of research on football within Scotland, hence the rationale for this studies focus on Scottish football. The majority of studies have been carried out on the English, German, French and Spanish professional football leagues (Araya & Larkin, 2013; Oberstone, 2009; Evangelos, Gioldasis, Ioannis, & Georgia, 2018). The

previous research has indicated a greater quantity of passes for successful teams. This study will analyse short passes in more detail, in which earlier studies have failed to examine.

### **3.0 Research Questions**

1. What significant difference in performance indicators is there between the top three & bottom three teams in Scotland's Premier League?
2. What difference exists in the type of passes between the top three & bottom three teams in the Scottish Premier League?
3. What variances exist with passing accuracy between the top three & bottom three teams in Scotland's Premier League?
4. What is the difference in shot variables between the top three and bottom three teams in the Scottish Premier League?

## **4.0 Methodology**

### **4.1 Conceptual Framework**

The following research incorporated a quantitative design, the governing methodology used in sport research, which gathers a measure of numerical quantities (O'Donoghue, 2010). Quantitative designs are regularly applied due to the objectiveness, whilst repeating the procedure by numerous examiners only showing slight differentiation within the results (Gratton & Jones, 2010).

### **4.2 Data Sources**

A total of 198 matches were analysed as part of the research. The total is a full seasons' worth of matches from the top three and bottom three teams in the 2017/2018 Scottish Premiership League prior to the top six and bottom six league table split. The study examined 33 games per team. However, the quantity of matches may have impacted the variables within performances. The uneven number of matches required teams to play an opponent three times throughout the season (two home matches & one away match or in reverse). The reasoning for assessing a full season worth of games was based on previous research papers

by Araya & Larkin (2013) and Lago-Peñas et al. (2010). Consequently, a full season’s data presented sufficient information, but in order to identify specific variables that influence success, a full set of matches would need to be documented over multiple seasons. All of the match footage was gathered from a private online scouting and analysis database called Wyscout. Permission was sought for the downloading of match footage for the specified teams.

### 4.3 Variables Definitions

*Table 1 Definitions of Attacking Variables*

<b>Attacking Performance Variables</b>	<b>Definition</b>	<b>Successful</b>	<b>Unsuccessful</b>
<b>Goal</b>	When the ball passes completely over a goal line at the end of field of play		
<b>Shot In</b>	A shot from inside the box	Makes the Goalkeeper work, cleared off the line or a goal	Off target, blocked, hits post of crossbar
<b>Shot Out</b>	A shot from outside the box	Makes the Goalkeeper work, cleared off the line or a goal	Off target, blocked, hits post of crossbar
<b>Side/Backwards Pass</b>	A pass that keeps possession but does not bring the team higher up the pitch or initiate attacking movement	Retains Possession	Loss of possession
<b>Forward Pass</b>	A pass in a forward direction less than 25m	Retains Possession	Loss of possession
<b>Penetrative Pass</b>	A pass that eliminates/splits opposition players and forces them to move toward their own goal (Line break, switch of play or through ball)	Retains Possession	Loss of possession
<b>Long Pass</b>	A Pass of more than 25m intended to hit a player/area to allow a teammate to attack	Retains Possession	Loss of possession
<b>Cross</b>	A ball delivered into the box inside the final third which gives a teammate a chance to attack		
<b>Dribble</b>	A forward movement with the ball unopposed		

#### **4.4 Data Collection Methods**

The analysis was carried out using Nacsport software (Las Palmas de Gran Canaria, Spain). Each game was individually analysed using specifically designed tagging panel (see Appendix A). The tagging panel was applied to quantify specific technical events of the team's performance. Every tagged event was then interrelated to the outcome of the team's performance.

#### **4.5 Reliability**

To test the reliability of this study, an inter-reliability procedure was carried out. Similarly to Scoulding, James and Taylor (2004), an independent observer with experience working as a performance analyst in professional football was sent a randomly selected match to tag the performance variables. The results were then compared to the findings of this study. A Kappa scored between the range of -1.0 and +1.0 which is considered a reliable score.

#### **4.6 Data Analysis**

The following section outlined the overall findings for this investigation. The descriptive statistics were used to differentiate the performance variables for the two groups. The top three teams were defined based on their final league positions, the top team was defined as T1, the second placed team was T2 and the third placed team was T3. The bottom 3 teams were defined using the same method, the third from bottom placed team was defined as B1, the second from bottom team was B2 and the team bottom of the table was B3. Replicating Araya and Larkin's (2013) study, Shapiro Wilk statistics ( $p \leq 0.05$ ) were carried out to evaluate the normality of the data's distribution, which outlined that the performance variables were not normally distributed, with long passes being the only variable normally distributed. Furthermore, a Mann-Whitney U test was used to highlight any significant discrepancies in performance variables between the top three and bottom three teams in the Scottish Premier league. Significance level was set at  $p < 0.05$ , data was analysed using SPSS Statistics for Windows, version 22.0 (IBM Corp, New York). Additionally, using the same SPSS statistical software, an independent sample t-test ( $p \leq 0.05$ ) was used to check for statistical significance between the two groups in the normally distributed variable

## 4.7 Ethical Considerations

As part of this study, a large amount of video files and data was collected. It was important the video footage and data was stored in a secure location. All the data involved in this research was securely stored on a password protected personal computer and backed up on a personal hard drive to avoid any data being leaked to unauthorised personnel.

## 5.0 Results

All the data was checked for normality using a Shapiro Wilk test which indicated that data was not normally distributed, excluding the long passes data which was shown as a normal distribution. Therefore non-parametric statistics were used to analyse the differences between the two groups illustrated below (See tables 2 & 3). A Mann-Whitney U test ( $p \leq 0.05$ ) indicated a significant difference between the top three and bottom three teams in the attacking performance variables at the conclusion of the season. The top three teams had significantly more dribbles ( $U= 2665.50, z= -5.55, p < 0.001$ ). The shot variables also showed that the top three teams had significantly more shots inside the box ( $U= 2773.50, z= -5.29, p= < 0.001$ ), shots outside the box ( $U= 2622.50, z= -5.69, p= < 0.001$ ), shots on target ( $U= 2854.00, z= -5.11, p= < 0.001$ ), and shots off target ( $U= 2641.00, z= -5.62, p= < 0.001$ ) in comparison to the bottom three teams. In Contrast, there was no significant difference in crosses between the two groups ( $U= 4756.50, z= -0.36, p < 0.72$ ).

A Mann-Whitney U test also demonstrated that the bottom three teams had significantly less forward passes ( $U= 2078.50, z= -7.00, p= < 0.001$ ), side/backwards passes ( $U= 1394.00, z= -8.698, p= < 0.001$ ) and penetrative passes ( $U= 2023.50, z= -7.01, p= < 0.001$ ) compared to the top three teams in the league. As long pass data was normally distributed, an independent sample t-test was conducted which indicated that the top three teams ( $M= 21.12, SD= 8.26$ ) had significantly fewer long passes than the bottom three group ( $M= 27.23, SD= 7.82$ ) throughout the season ( $t(195) = -5.33, p= < 0.001$ ). The top three teams' were shown to have a higher overall passing accuracy than the bottom three teams (83.32% vs 76.77%). Further break down of the pass variables, the bottom three teams had a greater passing accuracy for long passes compared to the bottom three group (46.40% vs 45.02%). Furthermore, the top three teams had a greater passing accuracy across the remaining pass variables; forward pass

(82.45% vs 70.45%), side/backwards pass (95.70% vs 93.16%) and penetrative pass (65.35% vs 64.33%).

Table 2 Differences in the Top 3 and Bottom 3 Team's Attacking Performance Indicators

<b>Top 3</b>	<b>Cross</b>	<b>Dribble</b>	<b>Shot Inside The Box</b>	<b>Shot Outside The Box</b>	<b>Shot On Target</b>	<b>Shot Off Target</b>
<b>T1</b>	17.67 ± 1.01	87.79 ± 4.44	11.27 ± 0.58	9.24 ± 0.80	6.76 ± 0.43	13.76 ± 0.94
<b>T2</b>	17.73 ± 1.27	36.88 ± 2.53	8.34 ± 0.56	5.91 ± 0.52	4.61 ± 0.45	9.21 ± 0.79
<b>T3</b>	22.73 ± 1.77	58.88 ± 3.66	10.36 ± 0.77	5.76 ± 0.51	5.15 ± 0.49	10.97 ± 0.84
<b>Mean</b>	19.37	61.18	10.01	6.98	5.51	11.31
<b>Standard Deviation</b>	8.24	29.41	3.97	3.95	2.76	5.22
<b>Standard Error</b>	0.83	2.96	0.40	0.40	0.28	0.52
<b>P Value</b>	0.721	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
<b>Bottom 3</b>						
<b>B1</b>	22.21 ± 1.29	33.55 ± 3.09	7.30 ± 0.67	4.36 ± 0.39	3.52 ± 0.37	8.15 ± 0.58
<b>B2</b>	17.42 ± 1.21	49.42 ± 2.91	7.70 ± 0.78	4.82 ± 0.42	4.18 ± 0.40	8.33 ± 0.69
<b>B3</b>	19.15 ± 1.28	36.97 ± 1.99	5.52 ± 0.57	3.39 ± 0.32	2.91 ± 0.31	6.00 ± 0.54
<b>Mean</b>	19.6	39.98	6.84	4.19	3.54	7.49
<b>Standard Deviation</b>	7.44	16.86	3.98	2.23	2.12	3.62
<b>Standard Error</b>	0.75	1.69	0.40	0.22	0.21	0.36

Data is presented as mean ± standard error. \* Significant difference between the two groups

Table 3 Differences in the Top 3 and Bottom 3 Team's Passing Performance Indicators

<b>Top 3</b>	<b>Forward Pass</b>	<b>Side / Backwards Pass</b>	<b>Long Pass</b>	<b>Penetrative Pass</b>
<b>T1</b>	274.76 ± 12.00	280.79 ± 13.16	12.82 ± 1.00	11.70 ± 0.75
<b>T2</b>	140.58 ± 6.69	136.79 ± 7.14	25.50 ± 0.80	7.84 ± 0.62
<b>T3</b>	180.27 ± 7.04	168.64 ± 8.22	25.18 ± 1.18	9.12 ± 0.67
<b>Mean</b>	198.54	193.40	21.12	9.57
<b>Standard Deviation</b>	29.41	83.64	8.49	4.27
<b>Standard Error</b>	2.96	8.41	0.85	0.43
<b>P Value</b>	<0.001*	<0.001*	<0.001*	<0.001*
<b>Bottom 3</b>				
<b>B1</b>	120.33 ± 5.33	88.06 ± 5.09	25.79 ± 1.26	3.79 ± 0.47
<b>B2</b>	139.52 ± 5.70	123.45 ± 7.13	26.00 ± 1.22	6.88 ± 0.58
<b>B3</b>	143.91 ± 6.82	107.64 ± 6.49	29.91 ± 1.50	5.58 ± 0.51
<b>Mean</b>	134.59	106.38	27.23	5.41
<b>Standard Deviation</b>	35.55	38.62	7.82	3.22
<b>Standard Error</b>	3.57	3.88	0.79	0.32

Data is presented as mean ± standard error. \* Significant difference between the two groups

*Table 4 Differences in Pass Completion Percentages between the Top 3 and Bottom 3 Teams*

	<b>Forward Pass</b>	<b>Side/Backwards Pass</b>	<b>Long Pass</b>	<b>Penetrative Pass</b>
<b>T1</b>	9067 (8055)	9266 (8970)	423 (183)	386 (248)
<b>Pass Completion %</b>	88.84%	96.80%	43.26%	34.25%
<b>T2</b>	4639 (3413)	4514 (4264)	816 (374)	251 (160)
<b>Pass Completion %</b>	73.57%	94.46%	45.83%	63.75%
<b>T3</b>	5949 (4737)	5565 (5279)	831 (375)	301 (205)
<b>Pass Completion %</b>	79.63%	94.86%	45.12%	68.11%
<b>B1</b>	3614 (2307)	2611 (2382)	767 (367)	116 (77)
<b>Pass Completion %</b>	63.84%	91.22%	47.84%	66.38%
<b>B2</b>	4604 (3467)	4074 (3848)	858 (417)	227 (137)
<b>Pass Completion %</b>	75.30%	94.45%	48.60%	60.35%
<b>B3</b>	4752 (3363)	3552 (3307)	987 (428)	184 (125)
<b>Pass Completion %</b>	70.77%	93.10%	43.60%	67.93%
<b>Top 3</b>	19655 (16205)	19345 (18513)	2070 (932)	938 (613)
<b>Pass Completion %</b>	82.45%	95.70%	45.02	65.35%
<b>Bottom 3</b>	12970 (9137)	10237 (9537)	2612(1212)	527 (339)
<b>Pass Completion %</b>	70.45%	93.16	46.40%	64.33%
<b>Top 3</b>	42008 (36263)			
<b>Pass Completion %</b>	86.32%			
<b>Bottom 3</b>	26346 (20225)			
<b>Pass Completion %</b>	76.77%			

Data is presented as total passes (completed passes)

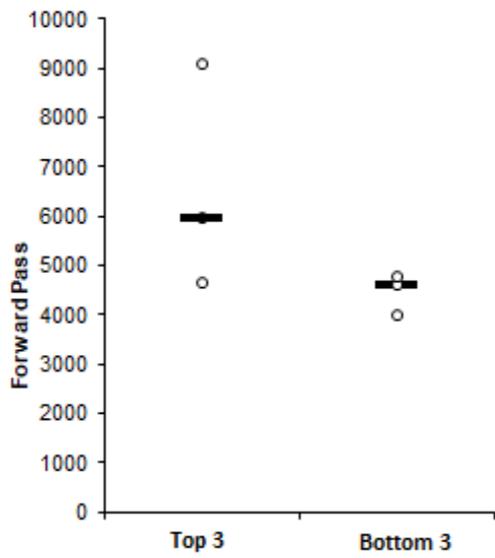


Figure 1 The Top 3 and Bottom 3 Forward Pass Totals

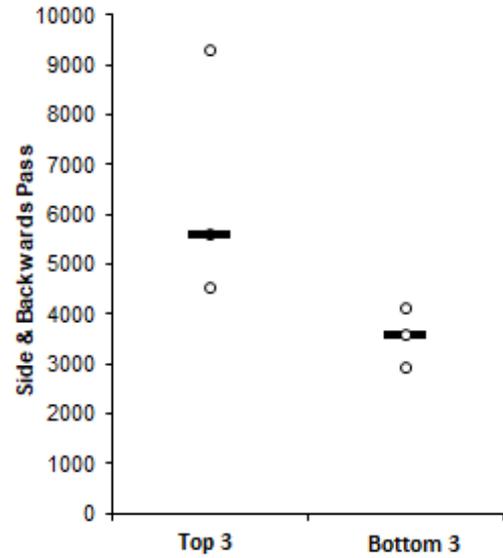


Figure 2 Top 3 and Bottom 3 Side/Backwards Pass Totals

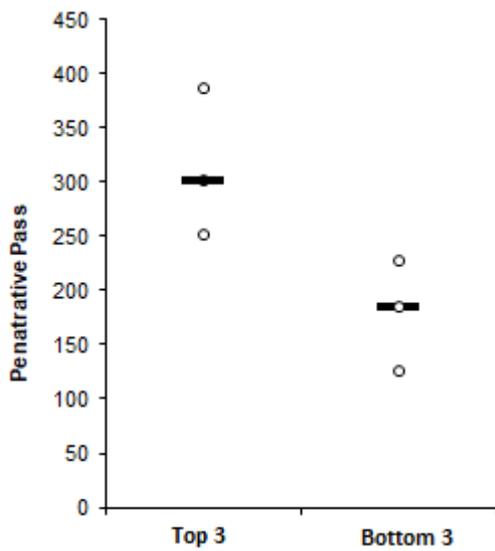


Figure 3 Top 3 and Bottom 3 Penetrative Pass Totals

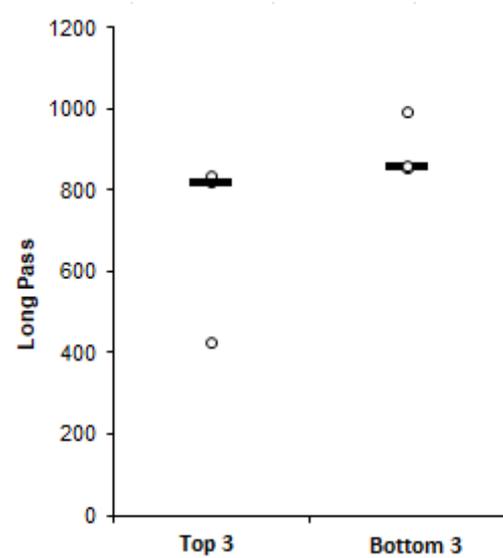


Figure 4 Top 3 and Bottom 3 Long Pass Totals

*Table 5 Differences in Shot Effectiveness and Shots Per Goal*

	<b>Total Shots at Goal</b>	<b>Shot Inside The Box</b>	<b>Shots Outside The Box</b>	<b>Shots Per Goal Scored</b>
<b>T1</b>	674 (223)	372 (137)	305 (86)	10.53
<b>Shot Effectiveness %</b>	33.09%	36.83%	28.20%	
<b>T2</b>	456 (152)	267(102)	189 (50)	6.81
<b>Shot Effectiveness %</b>	33.33%	38.20%	26.46%	
<b>T3</b>	532 (170)	342 (129)	190 (41)	10.64
<b>Shot Effectiveness %</b>	31.95	37.72%	21.58%	
<b>B1</b>	355 (109)	222 (83)	133 (26)	9.86
<b>Shot Effectiveness %</b>	30.70%	37.39%	19.55%	
<b>B2</b>	413 (138)	254 (95)	159 (43)	13.32
<b>Shot Effectiveness %</b>	33.41%	37.40%	27.04%	
<b>B3</b>	294 (96)	182 (64)	112 (32)	11.31
<b>Shot Effectiveness %</b>	32.65%	35.16%	28.60%	
<b>Top 3</b>	1662 (545)	981 (368)	684 (177)	9.18
<b>Shot Effectiveness %</b>	32.79%	37.51%	27.31%	
<b>Bottom 3</b>	1062 (343)	658 (242)	404 (101)	11.42
<b>Shot Effectiveness %</b>	32.29%	36.78%	25%	

Data is presented as total shots (shots on target)

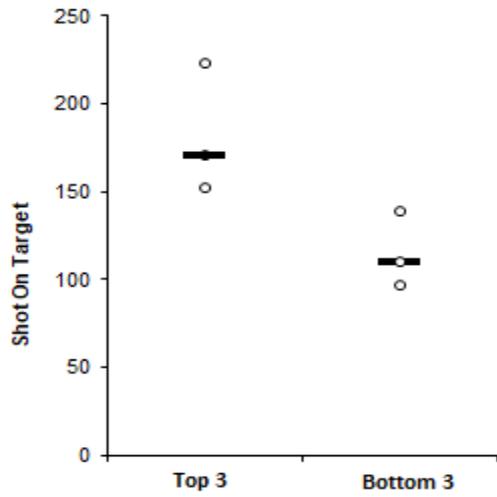


Figure 2 Shots On Target Totals

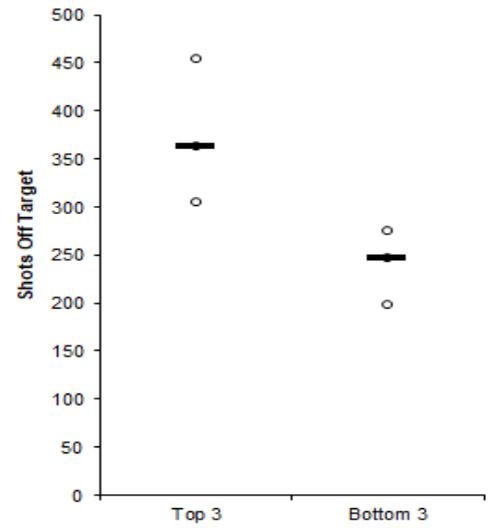


Figure 1 Shots Off Target Totals

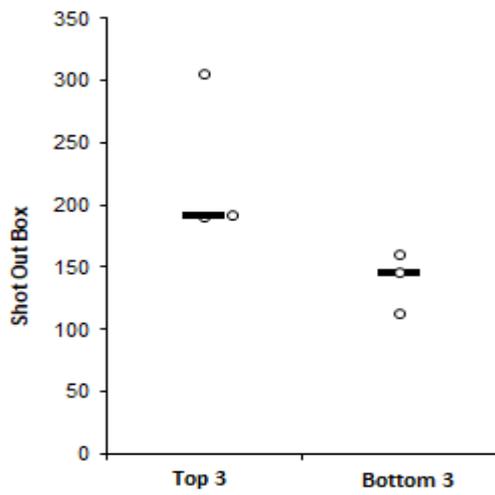


Figure 4 Shots Outside The Box

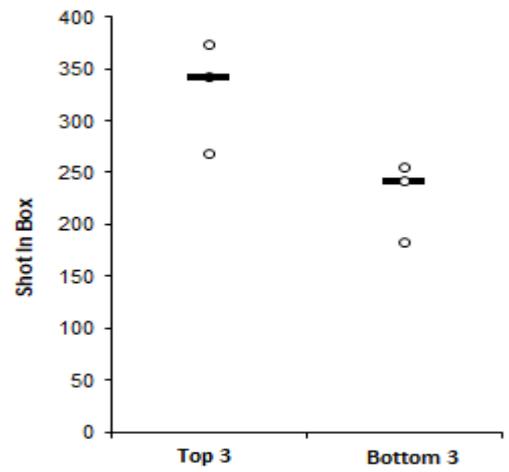


Figure 3 Shots Inside The Box

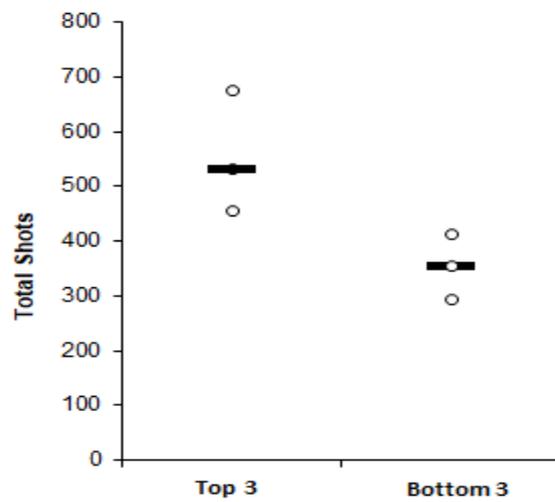


Figure 5 Total Shots

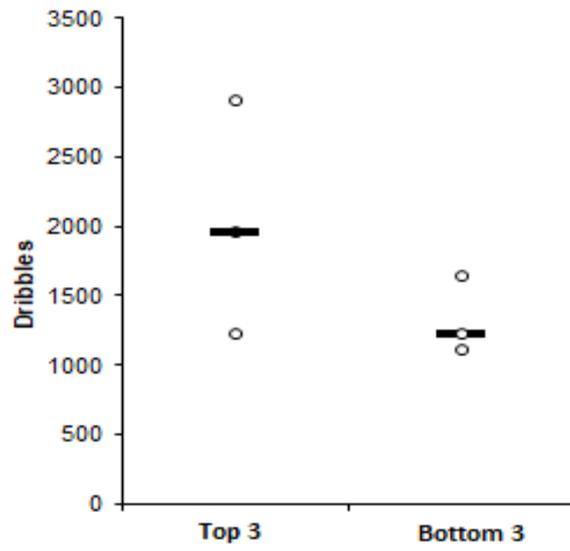


Figure 6 Top 3 and Bottom 3 Dribble Totals

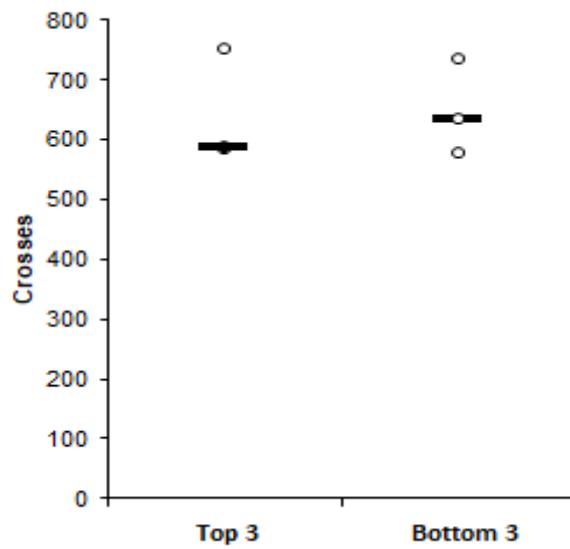


Figure 7 Top 3 and Bottom 3 Cross Totals

## 6.0 Discussion

The purpose of this study was to establish in game performance variables that differentiate successful teams (Top three) and unsuccessful teams (Bottom three) in the Scottish Premier League 2017/2018 season. The results from the present study indicate teams in the top three had more passes than teams that finished in the bottom three. This supports previous research in the English Premier League, (Araya & Larkin, 2013 & Oberstone, 2009) the Italian top professional league (Rampinini et al., 2009), the Greek football first division (Armatas et al., 2009) and the Spanish first division football league (Lago-Peñas & Dellal, 2010), whereby teams that finished higher in the league had more passes. Barnes et al. (2014) have shown the quantity of passes has increased over a seven season period in England top professional league. Previous research has only analysed passes as an overall variable (Lago-Peñas, Lago-Ballesteros & Rey, 2011), short and long passes (Araya & Larkin, 2013) or short, medium and long (Barnes et al., 2014). Unlike any of the previous research, this study dissected the passing variable into four specific modern day passing variables (Forward, side/backwards, long & penetrative). The results found that successful teams had attempted fewer long passes (>25+ metres) than unsuccessful teams throughout the season. In addition, successful teams had more forward passes ( $\leq 25$  metres) and side/backwards passes, suggesting that the teams finishing higher in the league table opted for a more possession based style of play maximising their changes of retaining the ball. These findings mirrored Araya and Larkin (2013), Oberstone (2009) and Barnes et al. (2014) studies that showed the top teams in the league had significantly more short passes than those teams that finished close to the bottom of the league table. In addition, this study found that the top three teams had a higher pass completion percentage (86.32%) compared to the bottom three teams (76.77%). The findings demonstrated that the successful teams had a greater pass completion percentage despite having significantly more passes than the unsuccessful teams. The greater amount of short passes increases a team's probability of maintaining possession, therefore it could be suggested that successful teams were able to control the tempo of matches.

With reference to shots at goals, this study found that the top three teams had significantly more shots at goal and a greater shot effectiveness than the teams in the bottom three of the league table. These findings replicate studies carried out in England, Germany and Greece which states teams finishing higher in the league table have a greater quantity of shots at goal and more shots on target (Araya & Larkin, 2013; Oberstone, 2009; Armatas, Yiannakos, Papadopoulou & Skoufas, 2009). Furthermore, this study found that the top three teams had

more shots on target which supports Armatas et al. (2009) findings that a greater quantity of shots on target is associated with successful teams. This study illustrates that higher finishing teams have a slightly greater shot effectiveness percentage (32.79%) compared to the teams that finished in the bottom three (32.29%). Although the results show a small difference in percentages, the top three teams had more shots on target (545) than the bottom three (343) increasing their chances of scoring goals which supports Yue, Broich, and Mester's (2014) findings that shot effectiveness is the most important variable for winning outcomes. A study carried out by Durlik and Bieniek (2014), found that 85.1% of goals in the English Premier League came from shots inside the box while Simiyu (2013) and Michailidis, Michailidis and Primpa (2013) showed an increase of 10% in goals scored from inside the box in International Association Football over a two year period.

No significant difference was found for crosses between the top three and the bottom three teams in the league. These results contradict Mara, Wheeler and Lyons (2012) and Lago-Peñas, Lago-Ballesteros, Dellal and Gómez (2010) findings, that crosses for are a key factor of successful teams. Mara, Wheeler and Lyons (2012) study was conducted on Australia's National Women's League (W-League) while Lago-Peñas, Lago-Ballesteros, Dellal and Gómez (2010) study was carried out on Spanish professional football, a league perceived for its free flowing possession football whilst this study was based on Scotland's top professional league known for its physicality whereby defenders maybe more equipped to defend crosses.

A significant difference was found between the two groups for dribbles with the top three teams having considerably more dribbles per game than the bottom three teams. These findings contradict research by Harrop and Nevill (2014) suggesting that the likelihood of winning matches increases if the team has fewer dribblers in the match. Multiple research papers support the findings of teams finishing higher up in the league table have a greater amount of dribblers per game (Araya & Larkin, 2013; Rampinini et al., 2009).

## **7.0 Conclusion**

Findings from this study highlighted the key performance indicators that may predict a successful league campaign in the Scottish Premier League. Results found that the top three league positioned teams had more dribbles, forward passes, side/backwards passes and penetrative passes than the teams positioned in the bottom three. In addition, the lower positioned teams had made more long passes than the top three teams. In relation to the shooting variable, the top three teams had more shots overall. Furthermore the breakdown of shots showed successful teams had more shots inside the box, outside the box and effectively had more shots on target. This suggests that to be successful in Scotland's Premier League, teams should adopt a more short passing, possession based style of play with the objective of creating shooting chances from within the box. These findings may assist coaches whose aims are to finish as high up the Scottish Premier League table as possible, to design training plans and develop tactical strategies that promote the football game play outlined in this study.

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# Appendices

## Appendix A: Code Window used to tag the in-match performance variables

