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The development, implementation and validation of an objective match scoring system for elite netball

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ABSTRACT

This study created and empirically validated an objective match scoring system for the dynamic and tactically rich sport of elite netball. Vast data was captured from all matches (488) played over five-seasons in the UK Netball Superleague. This was ordered into evenly weighted segments for each performance indicator, with each segment assigned a 0 to 10 value on a sliding scale, with the lowest segmented performances awarded a 0, and the highest a 10. Next, individual performance indicators for both teams in all 308 matches from seasons 2021, 2022 and 2023 were calculated an out of ten score, based on which segment they fell within. A resultant out of ten score for the overall match performance of each team was then computed, showing its objective strength. Use of this system was then implemented within elite coaches pre- and post-match analysis processes, with mixed methods utilised to ascertain the empirical validity in practice. Quantitative analysis concludes that the system accurately scores the outcome of matches with statistical significance, whilst qualitative data confirms the usefulness for elite coaching practice, specifically as an aid to previewing and reviewing performances. We conclude that the tool is an objective, trustworthy addition to the coaching process.

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1. Introduction

Growing in popularity, reach and professionalism, netball is a fast paced and dynamic team sport with the pace and ferocity at which it is played, alongside evolving and complex tactics, clear to see. Performance analysis has clear value in the coaching process, with a significant number of applied studies confirming its efficacy and value (Butterworth, 2023). That coaching process itself is a complex web of inter-relating facets, driven by context and environment in an evolving and dynamic manner often referred to as a messiness (Butterworth, 2023). Coaches must effectively navigate this mess in order to make effective performance decisions. In attempting to help in this process, the analysis seeks to provide objectivity, doing so at various stages of an evolving and ongoing cycle (Butterworth, 2023).

In the pre-match analysis stage of the cycle, it is well established that tactical preparations cognisant of opposition are enhanced through the use of analysis, and that data can help drive focus alongside tactical and game-specific contexts (Fernandez-Echevaerria et al., 2019; Groom & Cushion, 2004; Wright et al., 2013). Live match analysis, with an influx of technologies, is now allowing earlier interventions and the identification of emerging trends in game to impact in real time (Butterworth, 2023; Groom et al., 2011; Hughes & Bartlett, 2002). Debriefing meanwhile is now well documented, including Middlemas et al. (2018) works which indicates that athlete preference and mindset are key facets, whilst the balance of statistical data versus video, technological tools and time passed before undertaking a debrief are all also critical

considerations (Butterworth, 2023). What is typically unknown in empirical research is the value to which coaches place on certain aspects of this cycle and the analysis data they value in helping them navigate this.

Despite strong evidence of its worth elsewhere in other sports, performance analysis research specifically in netball has been historically sparse. Early papers in the field focused on the role of music on flow states and shooting performance (Pates et al., 2003) and the effectiveness of motivational videos (Jenkins et al., 2007). O'Donoghue et al. (2008) paper, briefly investigated the performance norms of Superleague netball, which signified the start of a slightly more frequent foray into the sport. Bruce et al. (2009) noted a biomechanical technique analysis which investigated the systematic differences in technique of junior and senior players goal shooting (Delextrat & Goss-Sampson, 2010). Further papers into the physical or technical demands of the sport (Chandler et al., 2014; McKenzie et al., 2020; van Gogh et al., 2020), or related to mechanics and injury prevention (Hopper & Elliott, 1993; Hume & Steele, 2000; McManus et al., 2006; Saunders et al., 2010) are also published. Whilst interesting, these papers do little to aid our understanding of the growing importance of the tactics employed in elite netball.

More recently, researchers have recognised this, and alongside the growing profile and reputation of the sport, empirical studies into the tactical aspects of the sport have been more forthcoming. Rose (2013) discovered insight into the performance indicators that discriminate between the top and bottom half teams in the British Netball Superleague, concluding that nine specific

performance indicators were significantly different between those finishing in the top and bottom half, though the paper only utilised 16 matches which is a very small proportion of the total number of games played. Pulling et al. (2016) paper discussed the singular team indicator of centre passes, using the same British league. Their paper discovered that there are particular nuances in the receiver's location and turn direction that impact somewhat on the success of a centre pass but again was based on a very small sample of matches ($n=7$) and makes no mention of any contextual variables and so the results are somewhat preliminary.

More coherent and valid tactical works have followed largely from research conducted in the Australian and New Zealand professional leagues. Croft et al. (2017) work offered an alternative to performance indicators in describing the patterns of play elicited in the game using large data sets from 252 matches from the ANZ Championship and organising them into seven game styles using contemporary clustering algorithms. The result allowed coaches and analysts to select a style of play and particular tactics which were fully considerate of opposition strengths and tactics. Meanwhile, Browne et al. (2019) presented research uncovering patterns of play using network analyses and computerised calculations to establish centre pass passing patterns, something which Young et al. (2023) followed up on with a link to match outcome, whilst McClean et al. (2019) also provided another novel method to analyse the sport, offering insights into work domain, uncovering the complex interactions and relationships between components of success. Other papers (Baker et al., 2022; Bruce et al., 2018; Hodder et al., 2023; Ofoghi et al., 2021) have continued to look at alternative tactical elements of the game but focusing predominantly on predictive modelling, and don't fully consider the usefulness of such in real coaching scenarios therefore limiting their applicability.

Though success in sport is often attributed to the score line and end result, there are a number of underlying variables (commonly known as performance indicators) which contribute towards that, cognisant of contextual inferences such as the opposition faced. Currently, there is no method by which to objectify and rank individual performance indicator data that helps interpret how, or critically why, the result was achieved. Resultantly there is no method as yet that can illustrate the strength of individual matches and indicators within those matches to help coaches and players understand the underlying foundations of their performances. Furthermore, many performance analysis-based studies and interventions are mathematical or lab based in nature and fail to consider the actual application of newly gained knowledge back to coaches who need to impart that upon their players in an attempt to enhance the result.

In summary, though there is increasing knowledge and innovation in the analysis of netball performance, so far these papers have focused on specific tactical plays, failed to consider the realities of performance, used narrow sets of performance indicators or very small sample sizes. Therefore, given the value of performance analysis, and the growing need for objectivity to assess performances accurately and help coaches navigate the messy coaching process, the current study seeks to develop, implement and evaluate a new method of evaluating netball match performance that can reliably and accurately

provide and signify an objective strength score for each individual indicator, alongside an overarching match score to better interpret and identify areas of strength, weakness and overall outcome.

2. Methods

Following institutional ethical approval (LEON ID: 6094), this study adopted a mixed methods approach set in two stages: (1) the development of the quantitative match scoring system and (2) the empirical validation of the match scoring system in coaching practice, split by two further subsections; (2a) statistical significance testing to establish the objective legitimacy of the method and (2b) qualitative evaluation with elite coaches to ascertain its usefulness in practice.

2.1. Quantitative match scoring system development

2.1.1. Performance indicator selection

A process of expert peer review was utilised to select the indicators to be included in the new match scoring tool (cf. Butterworth, 2023). Three elite coaches (two head coaches, one assistant coach) combining a total of 44 years of coaching experience, and three elite players combining 23 years of current senior first team and international playing experience (total 67 years) held formal conversations with the authors to elect the most important team-based performance indicators, with each indicator then being clearly defined by the group (Table 1).

2.1.2. Data collection

Data of each of the ten performance indicators was collected from every team in every game for the 2018, 2019, 2021, 2022 and 2023 Netball Superleague seasons, the premier competition structure for elite netball in the United Kingdom. Sampling all matches from these seasons resulted in a total of 488 matches, comprising 976 individual team performances. In 2020, the season was cancelled after only 17 matches due to the global COVID-19 pandemic, and so those games were excluded as the sample would have been incomplete and unbalanced. Two additional games were excluded from the 2021 sample due to their cancellation after a COVID-19 outbreak within one of the teams. Meanwhile, the 2021 season saw shortened games of 48 min due to governing body regulations related to the pandemic, as opposed to 60 min in all other seasons.

All data was captured via a league-wide reciprocal data sharing agreement whereby the home team of each game were responsible for the filming and coding before uploading to a central database. Descriptive reliability of the data collection mechanism was confirmed via the governing body who assessed the accuracy of coding from each team on a weekly basis via the senior analyst and internationally qualified technical coach. However, to further ensure reliability was present, additional inter-operator testing was carried out by the researchers, where a sample of six randomly selected matches (assessing both teams, resulting in 12 individual team performances) from the 2021 season were re-coded by one of the authors, and frequency counts were assessed (O2) using the

Table 1. Performance indicators and definitions.

Indicator Name	Acronym	Indicator Definition
Goals Scored	GS	The number of goals scored during the match by the team.
Centre Pass to Goal	CP2G	The percentage of centre passes which result in a goal without loss of possession in-between.
Centre Pass to Shot	CP2S	The percentage of centre passes which result in a shooting opportunity (scored or missed) without loss of possession in-between.
Live Turnover Total	LTO	The total number of live turnovers gained. e.g. the team takes possession without any stoppage in-between the opponents possession and their own, via means such as defensive rebound, interception or pick up.
Live Turnover to Goal	LT02G	The percentage of live turnovers which result in a goal without loss of possession in-between.
Live Turnover to Shot	LT02S	The percentage of live turnovers which result in a shooting opportunity (scored or missed) without loss of possession in-between.
Restart Turnover Total	RTO	The total number of restart turnovers gained. e.g. possession changes hands with a stoppage in-between from a side line, back line or free pass.
Restart Turnover to Goal	RT02G	The percentage of restart turnovers which result in a goal without loss of possession in-between.
Restart Turnover to Shot	RT02S	The percentage of restart turnovers which result in a shooting opportunity (scored or missed) without loss of possession in-between.
Shooting Success	SS	The percentage of unimpeded shots scored during the match.

same data collection process, and compared to the originally collected statistics from team analysts (O1) as seen in Table 2, with the performance indicators being determined using these frequency variables.

Kappa statistical testing was undertaken on reliability coding, comparing the possessions recorded in corresponding observations of three variables: team, possession type, and outcome. Because there were a small number of short possessions recorded in one observation that were not recorded in the other observation, each of these variables also required an additional 'null' value when determining the kappa statistics. The mean kappa values (with a range of kappa values) were 0.987 (0.952 to 1.000) for team, 0.962 (0.930 to 0.987) for possession type, and 0.959 (0.936 to 1.000) for outcome, indicating a near perfect agreement for all observed matches, in line with interpretation bands suggested by Cohen (1960).

2.1.3. Data ordering

Once the raw data from all individual matches were collected and databased from each performance, the data were ordered numerically from smallest to largest, where for each indicator the higher the number, the better the performance. The indicator data sets were then individually split into rank order. Cut-offs for each were calculated at 5% of the cumulative data, and then for every additional 10% until 95% so that each category

could be individually ranked between 0 and 10. These cut-offs were used in order to create 11 bands allowing for a score of 0–10 to be placed on each, so that an indicator value which now falls within the lowest band (0–5%) was scored 0/10, the next band (5–15%) scored as 1/10, and so on until the final band (95–100%) which was scored as a 10/10. This resulted in the creation of Table 3, the rank boundaries for each indicator to help interpret the strength of performance on each indicator. Take, for example, the number of goals scored, where according to all the historic data, if a match saw a team score 41 goals or less this is in the bottom 5% of all performances and classed as a 0/10. Performances where a team scored 70 or more goals meanwhile were in the top 5% of all performances recorded, scoring 10/10.

Having created the bandings for each indicator, the next stage was to create a tool to score individual performances (Figure 1). This was implemented in Microsoft Excel where first a row for the raw match data from any individual match was created, leaving space for the raw numbers to be added as necessary. Using a series of *IF* formulas, a row was created which read from the individual indicator category numbers in Table 3, to automatically output the out of ten score for that individual indicator, repeated individually for each indicator. Finally, the overall match score out of ten was created, taking into account each of the ten individual performance indicator ranks. It was agreed with the expert peer review group that

Table 2. Inter-observer agreement reliability.

Match	Team	Centre Passes						Live Turnovers						Restart Turnovers					
		Total		To Shot		To Goal		Total		To Shot		To Goal		Total		To Shot		To Goal	
		O1	O2	O1	O2	O1	O2	O1	O2	O1	O2	O1	O2	O1	O2	O1	O2	O1	O2
1	1	51	51	30	30	28	28	6	6	3	3	2	2	14	14	6	5	5	5
	2	51	51	42	41	39	39	17	16	14	13	14	13	17	18	15	16	12	13
2	1	47	47	37	37	36	36	9	13	8	10	6	8	15	12	12	10	12	10
	2	48	48	31	32	30	30	8	8	5	5	5	5	9	9	5	4	5	4
3	1	34	34	23	22	20	19	9	11	6	7	6	7	18	18	12	12	10	10
	2	34	34	22	22	20	20	9	10	4	5	4	5	14	14	5	4	5	4
4	1	45	45	38	38	37	37	16	17	10	10	9	9	10	9	7	7	7	7
	2	45	44	30	30	27	27	4	4	2	2	2	2	14	14	9	9	7	7
5	1	45	46	35	36	31	32	20	20	16	15	13	13	13	12	9	9	8	8
	2	45	45	25	25	21	21	15	16	12	12	11	11	8	7	4	3	3	2
6	1	48	48	33	33	32	32	14	15	10	11	9	9	11	10	9	8	7	7
	2	47	47	28	28	28	28	12	11	9	8	9	8	11	12	8	9	7	8

Table 3. Individual performance indicator ranks.

	GS	CP2G (%)	CP2S (%)	LTO	LTO2G (%)	LTO2S (%)	RTO	RTO2G (%)	RTO2S (%)	SS (%)
0	<41	<50	<58	<8	<37	<43	<10	<34	<40	<75
1	41–45	50–54	58–62	8–10	37–45	43–53	10–11	34–42	40–50	75–80
2	46–48	55–57	63–64	11	46–51	54–57	12	43–49	51–55	81–82
3	49–50	58–61	65–67	12	52–55	58–61	13	50–54	56–59	83–84
4	51–53	62–63	68–69	13	56–58	62–66	14–15	55–57	60–64	85
5	54–55	64–65	70–71	14–15	59–63	67–69	16	58–62	65–68	86
6	56–57	66–67	72–74	16–17	64–67	70–72	17	63–66	69–72	87–88
7	58–59	68–70	75–76	18–19	68–72	73–77	18	67–70	73–75	89
8	60–63	71–72	77–78	20–21	73–76	78–81	19–20	71–74	76–79	90–91
9	64–69	73–77	79–81	22–24	77–83	82–88	21–22	75–83	80–83	92
10	70+	78+	82+	25+	84+	89+	23+	84+	84+	93+

	Scored	CP2G	CP2S	LTO Total	LTO2G	LTO2S	RTO Total	RTO2G	RTO2S	Shooting	MATCH SCORE
Match data	64	75	82	15	87	87	13	77	77	90	
Category Scores	9	9	10	5	10	9	2	9	8	8	7.9

Figure 1. Match score calculator.

each indicator should be evenly weighted, given that each aspect is vital towards a successful overall netball performance. Therefore, the overall match score was created as an equal average of each of the ten indicators. For the 2021 season where games were reduced to 48 min, the threshold calculations were reduced by 20% in the integer-based indicators of goals scored, number of LTOs and number of RTOs to account for the 20% reduction in playing time. Percentage figures on all other variables remained at the same levels given the relative nature of percentage values.

2.1.4. Match score generation

The final stage was to generate match scores for all 308 matches from the 2021–23 seasons, a total of 616 individual team performances. These three seasons were selected as a balanced recent sample of the last full seasons played to ensure data currency,

and subsequently applicability of the tool in actual coaching practice. Raw data from each of the performances in these seasons were entered into the newly created tool, separated by season, team name and opposition to bespoke data collection sheets. An additional column was also added to display the resulting overall match score out of ten for the individual performance. [Figure 2](#) shows an example of one of these sheets, using the example of 2021 Superleague champions Loughborough Lightning, displaying their individual match raw data totals and the resultant match score from their regular season matches.

The emerging sheets for each season also allowed for the generation of ‘league tables’ for each individual indicator. This meant that the researchers could assess which team were best on each individual indicator and indeed where all teams ranked throughout the season, as per [Figure 3](#), the final rankings from the 2021 season. Leaders in each individual performance

Team 1	Team 2	GS	CP2G	CP2S	LTO_Total	LTO2G	LTO2S	RTO_Total	RTO2G	RTO2S	SS	Match Score
Lightning	Bath	44	59	59	11	64	64	11	64	73	88	4.5
Lightning	Wasps	44	69	73	11	64	64	12	50	56	88	4.8
Lightning	Mavericks	60	75	85	17	76	88	13	85	85	83	8.2
Lightning	Rhinos	70	79	84	16	69	69	16	81	88	91	8.5
Lightning	Stars	58	84	91	10	90	90	21	57	57	87	7.6
Lightning	Storm	56	71	73	12	67	83	16	81	88	86	7.6
Lightning	Pulse	52	70	74	14	71	71	16	56	69	90	6.8
Lightning	Sirens	43	69	79	11	67	73	10	70	70	76	5.4
Lightning	Thunder	50	67	69	10	60	60	12	58	67	86	4.8
Lightning	Sirens	61	67	69	12	83	83	22	82	86	86	7.7
Lightning	Dragons	76	78	88	27	70	78	23	78	78	86	8.7
Lightning	Wasps	52	75	75	8	75	88	13	77	77	84	6.8
Lightning	Mavericks	55	73	75	13	69	69	14	57	57	89	6.3
Lightning	Stars	50	74	85	6	67	67	14	71	71	82	6.1
Lightning	Storm	53	64	69	11	73	73	22	82	82	90	7.3
Lightning	Pulse	42	58	63	12	58	67	20	60	70	76	4.5
Lightning	Dragons	59	79	90	12	92	92	17	59	71	88	8.1
Lightning	Rhinos	59	66	70	10	100	100	15	80	80	88	7.5
Lightning	Thunder	46	65	78	13	54	54	5	60	60	84	4.2
Lightning	Bath	54	72	76	13	69	69	15	80	80	87	7.3

Figure 2. Loughborough lightning 2021 match score calculations.

	GS		CP2G		CP2S		LTO		LTO2G		LTO2S		RTO		RTO2G		RTO2S		SS	
1	Thunder	54.8	Thunder	74.3	Thunder	77.8	Bath	14.1	Thunder	73.0	Thunder	76.3	Lightning	15.4	Lightning	69.4	Lightning	73.3	Thunder	90.9
2	Lightning	54.2	Lightning	70.7	Lightning	76.3	Thunder	12.8	Lightning	71.9	Lightning	75.1	Bath	12.9	Thunder	67.3	Thunder	72.1	Bath	90.4
3	Rhinos	49.1	Bath	68.1	Bath	72.5	Lightning	12.5	Rhinos	70.1	Rhinos	74.1	Thunder	12.9	Bath	66.2	Bath	71.0	Wasps	87.9
4	Bath	47.5	Wasps	66.7	Mavericks	72.2	Pulse	12.2	Bath	65.0	Bath	70.1	Sirens	12.3	Wasps	63.7	Rhinos	70.6	Pulse	86.8
5	Wasps	44.2	Mavericks	66.6	Rhinos	72.0	Wasps	12.2	Sirens	63.8	Sirens	68.6	Rhinos	12.3	Rhinos	63.1	Sirens	69.4	Storm	86.4
6	Mavericks	44.1	Rhinos	66.0	Wasps	71.9	Mavericks	12.0	Pulse	62.7	Mavericks	68.0	Wasps	12.1	Sirens	60.6	Wasps	69.3	Stars	86.2
7	Sirens	41.2	Sirens	62.0	Sirens	70.0	Stars	11.5	Mavericks	62.5	Pulse	66.9	Mavericks	12.0	Mavericks	57.7	Mavericks	66.0	Lightning	85.8
8	Storm	38.8	Storm	60.8	Storm	65.5	Rhinos	11.3	Wasps	60.5	Wasps	66.0	Pulse	11.9	Pulse	56.3	Pulse	59.8	Mavericks	84.5
9	Pulse	38.6	Pulse	57.7	Stars	64.7	Sirens	11.1	Stars	58.7	Dragons	64.1	Dragons	11.3	Storm	53.7	Stars	57.4	Sirens	81.8
10	Stars	36.9	Stars	57.1	Pulse	63.7	Storm	10.1	Storm	56.2	Stars	59.8	Storm	11.0	Stars	53.0	Storm	55.5	Dragons	81.3
11	Dragons	35.5	Dragons	54.1	Dragons	61.5	Dragons	8.2	Dragons	55.4	Storm	59.3	Stars	10.0	Dragons	47.8	Dragons	53.2	Rhinos	80.8

Figure 3. League ranking of individual performance indicator values.

indicator can be seen for example, noting that Thunder were the league's best team for total goals scored (GS), CP2G and CP2S, whereas Loughborough Lightning ranked second in those metrics and led the way for restart turnover volume (RTO) and conversion to shot (RTO2S) and goal (RTO2G).

2.2. Match scoring system empirical validation

To assess the empirical validity of the tool in practice, quantitative and qualitative methods were utilised. This was important to assess that the match scoring tool is statistically accurate with regards to the scores awarded for each indicator and the match outcome quantitatively, and that the tool is useful for coaches and players within the coaching process qualitatively, the ultimate end users of any performance analysis intervention or innovation.

2.2.1. Descriptive data analysis

To interpret the quantitative accuracy of the tool in scoring matches accurately, a descriptive analysis of the match winner and their match score in comparison to the losing side was performed. It was expected that the winning team in each match played would have an equal or higher overall match score than their defeated opposition. To assess the accuracy of the tool in doing this, all 308 matches selected from seasons 2021–2023 were assessed and interpreted on an individual basis, and collectively for the three seasons together.

2.2.2. Inferential data analysis

Statistical tests were carried out to assess the validity of the match scoring tool. Statistical analysis was conducted using R version 4.2.0 (The R Foundation for Statistical Computing, Vienna, Austria). First, a correlation was established to assess the relationship between winning margin, and the difference between the team's match score ratings. Statistical significance was accepted at $p < .05$. To check if the data were normally distributed, a Shapiro–Wilk test was run, which showed with significance that the margin of victory data was not normally distributed ($W = 0.92$, $p < .001$). Resultantly, Spearman's ρ was used to run the correlation test, whereby the magnitude of correlation was interpreted using descriptors from Cohen (1988), with a large correlation defined as a ρ value > 0.5 , a medium correlation between 0.3 and 0.5, and a small correlation between 0.1 and 0.3. Second, a dependent paired t-test was run to assess if there were significant differences between the match score ratings of winners and losers. Data were again tested for normality with a Shapiro–Wilk, with the resultant data showing that the data was also not normally distributed

($W = 0.99$, $p = 0.017$). Having established this, the non-parametric paired samples Wilcoxon test was run.

2.2.3. Qualitative match scoring system validation

2.2.3.1. Participants. Two elite netball coaches were recruited via purposive and convenience sampling, both holding coaching roles within one of the competing elite United Kingdom netball teams sampled. Together, the coaches combined over 40 years of playing experience and 25 years coaching experience. Both personnel gave their consent to participate in the study and were assigned a pseudonym.

2.2.3.2. Procedure. To access the participants' perceptions and usefulness of the tool in aiding their coaching and decision-making practices, a semi-structured interview guide was developed. The guide was developed based upon previous coach perceptions-based studies (Anderson et al., 2022; Butterworth et al., 2012), seeking to focus primarily on the coaches' engagement with, and perceived value of, the analysis tool. Resultantly, seven themes to the questionnaire were developed: (1) involvement and experience in elite netball, (2) existing interpretation methods for match quality, (3) subjectivity and bias potential in coach interpretation, (4) perceptions and place of objectivity in match scoring, (5) usefulness of objective match scoring for coach decision making, (6) formats and receipt of match scoring information and (7) coaching process integration and reflection. Each participant was interviewed independently by the lead author, who has significant prior experience of interviewing.

2.2.3.3. Data analysis. Both interviews were transcribed verbatim by the lead author, before being sent to the participants to check for accuracy, a form of member checking. Given the small sample of coaches interviewed, in accordance with existing research (Ando et al., 2014) it was deemed that the sample was not large enough to warrant a full thematic analysis. Instead, focus was placed on eliciting the most important themes from the transcripts using methods regularly used in other performance analysis-based research. To this end, a focus was placed on across-method triangulation, whereby quantitative data are combined with selected qualitative data to interpret and make sense of a phenomenon (Jones et al., 2020; Thurmond, 2001). Integrating multiple data types together in such a manner increases confidence in the accuracy of data analysis and provides evidence towards the power of a subject matter (Jick, 1979; Thurmond, 2001).

Therefore, following successful use in previously published analysis research by Jones et al. (2020), authors on the paper independently selected pertinent participant comments from

each question of each interview. The emerging comments were reviewed and assessed independently, and mutual agreements made on the most valid information for inclusion. This approach has been used elsewhere with scholars confirming that it increased trustworthiness and credibility in qualitative research, leading towards an enhanced understanding of the contextual realities of the subject matter (Creswell, 1998; Guba & Lincoln, 1989; Jones et al., 2020; Spall, 1998).

3. Results

3.1. Quantitative results

In total, 308 regular season matches comprising 616 individual team performances were examined. An overall match score was produced for each individual performance, producing two match scores for each match played, one for each team. As per Table 4, of the 308 matches played, 304 had a winner, with 4 draws recorded throughout the seasons. Of those 308 matches, the median match score rating of winning teams was 6.5 (SD = 1.18), whilst the median match score rating of losing teams was 3.9 (SD = 1.21), with the match winner having the higher match score ranking in 288 matches, 92.3%. In all matches examined, the lowest overall match score was by Surrey Storm with a match score of 1.0, in their 28–53 loss to Loughborough Lightning during the 2021 season. Meanwhile, the highest match score recorded was 8.9, achieved twice by Manchester Thunder in their wins over London Pulse (57–30) and Celtic Dragons (69–33), during the 2021 season.

Descriptive findings emerge from the data which point towards a general positive uplift and increase in league quality over the course of the three seasons examined. In the 2021 season, the average match score across all 112 matches was 5.02, in 2022 when games returned to the full 60 min, this increased to 5.11, whilst in the 2023 season, over the course of the 90 regular season matches, the average match score increased relatively considerably to 5.46. Additionally, during the time periods examined, the league averages for individual performance indicator categories have increased circa 4%. This increase in individual indicators in part helps explain the higher average match scores and points towards a continually improving quality of the league, which appears to be a positive outcome for the sport which seeks future professionalism. That said, the authors also acknowledge that this may be interpreted as indicating a weakening in the defensive metrics as the attacking prowess increased.

Results from the statistical testing undertaken confirm the accuracy of the tool in helping assess the strength of individual performances using the out of ten system. Results from Spearman's ρ showed that there is a large, significant correlation between the winning margin and the difference in rating of the two teams ($\text{Rho} = 0.88, p < .001$), whilst the relationship between the match score and the match score rating was plotted, as per Figure 4.

The non-parametric paired samples Wilcoxon test showed a significant difference was again apparent between the values of the winners rating and losers rating ($V = 45275, p < .001$). The comparison of these was plotted on a boxplot as seen in Figure 5, with the match winners rating significantly higher than that of the losing team.

Owing to a significantly strong relationship, we can surmise that the tool successfully correlates between the difference in match score line and the subsequently applied match score rating out of ten. This indicates that the tool is able to successfully infer games whereby there was a larger goal difference between the two teams with a higher match score rating for the winner. Meanwhile, we can also conclude that the tool is able to split winning and losing teams successfully by their match score rating.

3.2. Qualitative results

Utilising the themes created for the interview guide, pertinent independently selected quotes as per the methodology presented above, are hereby displayed. Initial questions first confirmed participants' involvement and experience in netball as player and coach. Both confirmed their extensive experience with a combined 40 years playing and 25 years coaching experience.

3.1.1. Existing interpretation methods for match quality

Participants were asked to provide an explanation of how they currently assess the quality of netball matches;

It is from a subjective point of view, based on experience and based on time ... and you feel the shift in behaviours. (C1)

More from a science side ... the key areas of the game are recorded and sent back to us. They can help to challenge or confirm some of your own biases and subjective thoughts. (C1)

I use analysis and key stats to help understand the performance and what we have seen out on court (C2)

Table 4. 2021–2023 descriptive data results.

	2021	2022	2023	Total
Matches Played	108*	110	90**	308
Match Outcome Win	106	110	88	304
Match Outcome Draw	2	0	2	4
Winning Team Higher MS	101 (93.5%)	99 (90%)	84 (93.3%)	288 (92.3%)
Lowest MS	1.0	1.4	1.4	1.0
Highest MS	8.9	8.3	8.5	8.9
Average MS	5.02	5.11	5.46	5.20

*the 2021 regular season featured two games less due to two cancelled matches after COVID-19 outbreaks.

**the 2023 regular season featured one less team in the league than previous seasons due to the administration and subsequent exclusion of Wasps.

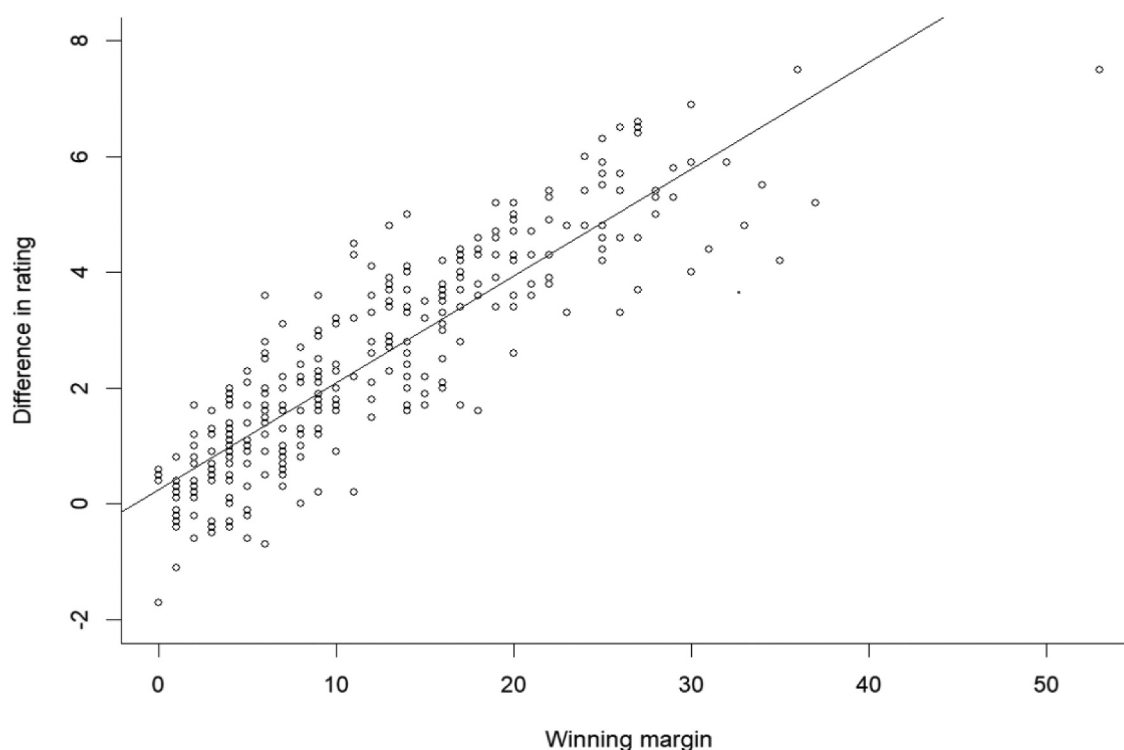


Figure 4. Match score and match score rating correlation plot.

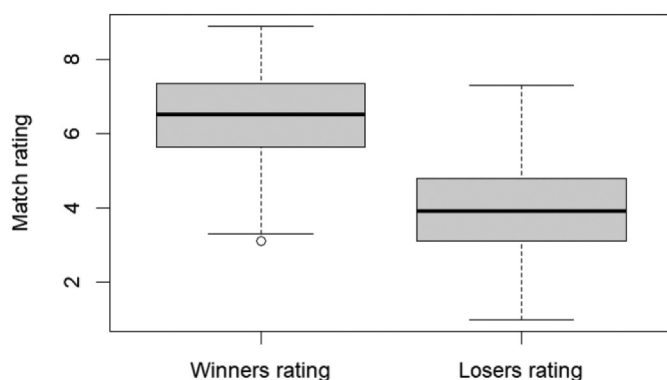


Figure 5. Boxplot of match winner and loser ratings.

3.1.2. Subjectivity and bias potential in coach interpretation

The coaches were asked how objective they felt they were in interpreting matches and decision making;

I am way more subjective than objective ... I am all about trying to help a person be better. Post-game our stats allow us to be more objective, but very quickly that turns to how can I make a person better again, which becomes subjective. (C1)

There is always a level of subjectivity and that is needed really. But stats are used to help support that and what you think ... conversations with other coaches are important too (C2)

3.1.3. Perceptions and place of objectivity

The inclusion of more objectivity into the coaching process and decision making was then discussed with the coaches, with

each offering their views onto the inclusion of more objective assessments of matches on a regular basis;

The objective side helps to confirm or challenge what you think you are seeing, so yes ... but I am nervous about data taking over and making decisions for you. (C1)

I think the data and objective side gives us further questions to ask ... identifies areas to investigate and get the right questions. There is a lot of context involved ... (C1)

... to find a balance between being data driven and instinct driven ... we can see trends with data which inform us heavily, these can mesh in with our coaching instinct (C2)

'... we don't want the players to stop taking risks and lose creativity, that's counterproductive ... but we do want data to help us understand the nuances in opposition and how we might exploit them'. (C2)

3.1.4. Usefulness of objective match scoring system

Having had the opportunity to utilise the match scoring system for a full domestic season, the coaches were asked to specifically reflect on the usefulness of the system in practice;

It is really useful, it provides us the opportunity to engage in more conversations with the athletes. It gives an easy to interpret score, and allows commonality in our language when we have conversations (C1)

We have used it as a different benchmark and it has really allowed us to identify how we are performing, and didn't allow us to drop our standards (C1)

The out of ten guides our training practice and where our attention is. It helps to explain decisions to players ... it gives a clear and quick overview of performance levels and areas which let us down or we excelled at. (C2)

Specifically, coaches elicited their views on how the match scoring information has helped back up or challenge their subjective interpretations on how a match progressed;

It really helped to reaffirm what we were seeing in the game ... we had a feel for how it was going, and this helps to confirm that at the end (C1)

... it helps change our reflection both ways, backing subjective with objective and vice versa ... it helps to provide consistency in our thought processes. (C2)

They were also then engaged in discussions around their feel when a match score might be high, but the team still lost, or if they had matches where their feel was different to the actual match score rating;

I think we felt in our game against [name redacted] that we were probably performing better than the match score said, but actually that is interesting in that it challenged our thinking and interpretation. (C1)

If we lost a game with say an 8/10, then that is ok still, we just need to be careful in our language and commonality of it. We acknowledge it was a high-quality game of netball and re-assess our expectations in those games. (C1)

... that's ok, because with this we can see areas in ours and their match score breakdown which we need to up or lower accordingly. (C2)

The coaches were then also asked around if the system could or should be extended to individual player ratings, as well as for the overall team;

I love the concept, but I don't think we are ready for that yet. It would have to come with education on why we would be doing it ... and consider the holistic development of the player, not just this. (C1)

We have to encourage creativity, not stifle it, which would be a danger if we started ranking players performances. Some players elsewhere are already being ranked, and the players don't really like it. (C1)

I think so, but it is hard to quantify everything all of the time ... it could become too much of a focus for individuals. (C2)

3.1.5. *Format, timing and receipt of match scoring information*

Both coaches were asked how quickly they liked to have the match score presented to them;

I like having it ASAP after the game, quickly to help us get confirmation ... it allows us to dig into things more and for more questions to be asked (C1)

Within a few hours ideally because it helps to inform our debrief and what we are going to say. Helps identify what areas we are going to pull out. (C2)

They also expressed views around timing and if they needed personal reflection time first, before learning the objective match rating;

No, it doesn't sway my thinking on the match ... we need it integrated in workflows now to interrogate the data more to get the detail (C1)

I have this instantly after the game, then we chat as a group. I still maintain this with or without the match score (C2)

Coaches then discussed the format of the match score rating coming back to them and how they'd perceived the way in which the data were presented back to them;

It is presented simply which is good and easy to read off ... visually is always beneficial ... I like to be able to see a picture of something (C1)

Just something simple, see the number on a one pager (C2)

3.1.6. *Coaching process integration*

The coaches were asked specifically about how they integrated the system into their coaching process workflows, specifically focusing on the use of the information for pre-match information, including opposition preparation;

It gives us a marker to which areas we exceed them in and should focus on ... (C1)

It is so useful, it helps us to see if we set our targets right or not ... which areas we need to focus on in training ... plus it gives us an objective indication of how we match up to our opposition (C1)

This is a really good yard stick of the opposition ... we can pull out trends on them, identify areas they are poor on and target them. We have to always look at where we can beat these teams, and this does that. (C2)

It gives us direction on where the emphasis should be ... knowing which thing could turn the game for us, then target that and hammer that thing. (C2)

Similar questions were asked too of post-match integration and if the match rating produced is a suitable way of assessing match performances, and they integrated and combined that with other post-match feedback formats;

It helps with consistency of feedback practice, having it every time ... we integrated it alongside our video reviews and feedback. (C1)

The next step might be to get the players to explore that differently, get their interpretation of it and their feel of it and their game intelligence (C1)

It is really useful as an aid to our debriefs to help overview, then we can branch off into the areas to discuss. It is a guide to help guide our practice. (C2)

Evolving in importance and popularity, the interdisciplinary sport science team (IDT) were considered next, as coaches expressed their views on how the match scoring system might be useful for other IDT practitioners within the coaching process;

It helps everyone in the IDT to understand how we play and how we need to win the game ... there is impact on multiple disciplines and them linking to knowing what it takes for us to win, linked to their own discipline interventions (C1)

It starts a conversation, it doesn't give the why, but it allows others to pick things out and start our conversations about how we solve things. (C2)

The coaches were asked to comment on how they thought the athletes valued the match score rating system;

It is a mixed bag ... some wanted to drill into the data more and it helped them to understand the importance of how we succeeded as a team ... but it didn't impact on some who didn't take to the court (C1)

There is the potential danger that they could hook onto it and pass blame for a performance onto this or something else. (C1)

They responded pretty well to it, it gives them a measure ... and it helps with their self awareness. (C2)

Finally, coaches were asked a summary question as to if they thought the match score rating system had a place in netball analysis moving forward;

Yeah definitely ... it has real impact and gives us priority areas, if our targets are right or not, how we match up against others. (C1)

I'd say so, for us it works really well ... it provides information as simply as possible (C2)

4. Discussion

The out of ten match score rating system can accurately rate match performances, by splitting winning and losing teams with statistical significance. Importantly, coach validation has followed with two elite coaches providing a depth of insight which confirms the usefulness of the tool in elite coaching practice as a legitimate aid to the coaching process.

Statistically, the system has provided significant results to indicate that it is an accurate tool by which to help interpret the actual strength of individual teams' performances, in relation to the large database of collated historical performances. Descriptively, of the 308 matches where a match score was generated, the system successfully scored the winning team higher in 92.3% of instances. Further, there is a significant and very large positive relationship between the final score margin of the match and the awarded out of ten match score, as too is a significant difference between winning and losing teams apparent. Whereas Rose's (2013) paper indicated differences between top and bottom half teams in the Superleague, these results provide a more detailed breakdown and accurate interpretation of the indicator values that underpin each team's league position. This provides confidence that as an aid to the coaching process, the created tool can distinguish between specific indicator values of strong and weak performances with accuracy to aid coaching decisions.

With its precision confirmed, the richness of comment in the qualitative data from two elite coaches is vital in helping understand the place of this tool moving forward in the sport. In the pre-match phase of analysis, coaches are confident that the tool has a place to aid specific preparation and tactical plans being set for upcoming opposition by utilising the individualised performance indicator rankings. Without the aid of an objective tool, the coaches both commented that there is a significant amount of subjectivity in their workflows, which can be problematic due to issues with recall, bias and favouritism (Hughes & Bartlett, 2008; Wright et al., 2012). That said, removing subjectivity and expert opinion entirely would make sport a less attractive offer, remove its dynamic nature and become a poorer product which lacks excitement and unpredictability (Butterworth, 2023). Coaches in this study agree, stating that subjectivity must remain as not everything can be measured and to be careful not to remove creativity and bravery, indicating that there is a balance to be struck, with this tool an aid, not a replacement.

With the aid of the match-scoring tool, coaches suggest that conversations are better informed and allow for a commonality in language. Coaches also explicitly explained how the match score rating directly helps guide their training practice design by allowing them to tailor their pre-match preparations to the opposition strength or weakness and gives clarity on decision making for which areas are to be focused upon. This aligns with previous research into the pre-match phase of analysis from Fernandez-Echevaerria et al. (2019) who discovered that plans are enhanced with the use of analysis and opposition knowledge engrained too, whilst Wright et al. (2013) found that the use of performance analysis-based data such as this tool, helps in driving the focus for upcoming matches. Groom et al. (2011) stated that pre-match analysis helps with developing effective styles of play too, which correlates to coaches views here too, stating that the match score tool and individual performance indicator tables help them to make tactical decisions as a benchmark for success, whilst maintaining high standards of performance.

Match analysis in game has been previously evidenced as a vital cog in the coaching process (Groom et al., 2011). The addition of the match scoring system appears to enhance that further, with coaches commenting that the tool helps them to reaffirm or challenge their reflections in-game, to the objective outcome of the match score. This addition of further objectivity to the process of reflecting in a game, allows the coaches to realign their messaging to players and productively challenge and realign their reflections where needed if challenges become apparent. The role of this cannot be understated given the volume of information that coaches forget from matches, and the important role that performance analysis has in helping plug that information deficit (Butterworth, 2023). Given also that Guitierrez-Aguilar et al. (2016) noted that performance levels increase after reinstruction from coaches live in game, it helps us to rationalise the role in objectifying that feedback more with a tool such as this.

The use of the match scoring tool post-game was highlighted as significantly important to the coaches in this study. Research promotes the balance of data and video for debriefing protocols in helping distinguish what went well and areas to develop further (Middlemas et al., 2018). The addition of this match score post-match allowed the coaches to see objectively and identify these areas more accurately, confirming that it has helped change their reflection processes with acute objective data. The coaches explicitly discussed integrating the match score calculations alongside their video reviews and feedback too, being a significant help to their debriefs, whilst also suggesting future potential avenues around player ownership and intelligence. Consistency and timing of use is also an important factor for the coaches, where they stated having the score available quickly after each match helps structure their debriefing. This is similar in nature to other research (Butterworth et al., 2013; O'Donoghue, 2005) that highlighted the significance of real-time analysis feedback for impactful use within the coaching process.

Ranking each indicator in a league table format, provided weekly to coaches, was seen as a significant positive, with both noting that this gave them direction and focus areas to assist in preparations. The importance of identifying indicators of

particular note via this ranking allows for subsequent coaching attention to be provided to those areas sooner. Earlier research by Butterworth et al. (2013) has confirmed that the role of performance analysis is to help with performance outcomes, and so being able to identify and drill down specific areas of performance in an objective manner ranked against other teams in the league is a positive addition and improvement on existing techniques.

The optimum time for a post-match debrief to be undertaken is 24–36 h after match completion, allowing for initial emotions to subside and a more rational view to be developed (Butterworth, 2023). The coaches in this study agreed with maintaining this time frame to deliver, though through interview questioning suggest that having the match score available to them as soon as possible helps their debriefing preparations, one of the two stages of debriefing as suggested by Macquet et al. (2015). It is therefore evident that the tool created helps to bring valuable objectivity to debrief preparations to further help enhance the quality of debriefing to be undertaken. Enabling this is the responsibility of the analyst as part of their match day workflows, with the system described in this paper helping to enable this in a time efficient manner. That said, the implementation of any new system or technology must be carefully considered pedagogically to ensure that it aligns to existing workflows and compliments processes to further enhance practice and performance (Butterworth, 2023). The positive affirmation of this tool also offers further avenues for a more detailed tactical analysis to be undertaken, akin to that of Browne et al. (2019) and Croft et al. (2017), whereby the individual tactics employed by teams, and the resultant impact upon individual performance indicator values as well as the overall match score rating.

Future research is needed to assess the impact that differing strengths of opposition have on the match score ratings, since various research including Butterworth (2023) notes that opposition significantly impacts the outcomes of performance. The current system does not account for differing strengths of opposition, and although this was not the intention of the current research paper, it would be an interesting follow-up. Other additional works might also explore the concept of match score ratings for individual playing positions within netball. Though any such works would need to carefully consider the psychological implications, especially given coach comments in this research suggest caution is needed in this space so not to divert player attention purely to numbers and away from creativity and bravery in performance. Predictive modelling might also be explored based on this system, in attempting to understand more about the specifics of how to beat a certain opposition and enhance pre-match analysis plans. These types of research remain desperately in need in netball, which continues to be underrepresented.

It is acknowledged that a limitation of the system is whereby there is a potential situation where a team gets one live and/or one restart turnover, scoring from both. This therefore would create a situation whereby they will have a 100% success rate (scored as 10/10) for the indicators of RTO2S, RTO2G, LTO2S and LTO2G and thus outweigh the marks lost for the two small frequencies of turnover. However, the reality of such a situation is exceptionally rare

in netball, given the high number of turnovers that typically occur. It is also accepted that single turnovers can sometimes be the difference in this high scoring sport, and so if scoring from a solitary turnover thus results in victory and a higher overall match score, this is in reflection of the game state and outcome. The system to date also only assesses the attack prowess of teams, rather than defensively and so this may limit applicability to all areas of the game.

5. Conclusions

This paper has showcased the empirical validation of a new tool to objectively assess match performance in netball. Embedded in real-world practice, the tool has provided evidence that collating performance indicators and transforming these into match scores, is a valid and reliable addition to performance analysis and coaching in the sport. Leaning on influence from performance profiling, the match scoring tool enables an unbiased and fair interpretation of performance level, whilst maintaining accuracy in understanding the most important indicators to the outcome of a match. In interviews, coaches confirmed the usefulness of the tool in practice, citing the important role that the tool plays in their match reflection and subsequent planning. Above all, the research has demonstrated that the tool created is a useful aid, adding valuable objectivity to decision making, reflections and future planning.

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