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Students Perceived Use of Mathematical Knowledge and Skills in Reading, Constructing and Interpreting Football League Table: Ethical Implications for Mathematics Education

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Abstract: *This paper examined students' perceived use of basic mmathematical knowledge and skills in reading, constructing and interpreting football league tables. To guide the study, three research questions were raised and two hypotheses were formulated and tested at 0.05 level of significance. The study employed the survey design and the sample size was 190 students: 94 males and 96 females, from ten (10) secondary schools in Edo South Senatorial District of Edo state. A 7 items questionnaire was administered to collect the data. Mean and Standard deviation were used to answer research question one, and the independent sample t-test statistic was used in testing the two hypotheses. The study revealed that students need mathematical knowledge and skills in reading and preparing football league tables. The educational and ethical implications for mathematics education were outlined, and recommendations were made.*

Key Words: *Football, Mathematical Knowledge and Skills, Football League Table*

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Introduction

Football is a popular sport with large youth followers all over the world. The street, local, national and international players are youths. The supporters and admirers of football players and teams are mostly from the youth population who spent money and time to watch live football matches in local and international leagues. Others, adults, youths and children do glue their eyes to their television sets to watch football matches. These youth football lovers, who are in their teens, are in primary and secondary schools and study one form of Mathematics or the other.

Mathematics is a core and compulsory subject at both primary and secondary schools. However, the level of Mathematics literacy of Nigerians is reportedly questionable (Ogunkunle & Adeyemi, 2013)'. This may have resulted from the poor background of most adults in Mathematics while in primary and/or secondary school level. Over the years poor performance of students in Mathematics in the senior school certificate examinations has been well documented. Generally, students, parents, teachers and the public perceived Mathematics as a difficult, abstract complex subject to study. These general misconceptions about Mathematics education have led to general hatred for the subject in school. Therefore, Mathematics as a subject has been made unpopular among students in schools. On the other hand, football is a very popular sport among students, and linking football activities and analysis to Mathematics will

make the subject popular and generate students' interest and cultivate the right attitude towards learning the subject. To Adetula and Ale (2005):

> *One way of developing attitudes, interests and values in students is to relate Mathematics teaching and learning to real-life situations. Football games are real-life situations and they would serve as enrichment content to stimulate students' interest in mathematics*.

Michael and Iyekekpolor (2013) concluded that the use of games in Mathematics education has enjoyed considerable empirical support as being helpful and useful in reducing students' phobia and increasing their enthusiasm for the study of Mathematics. Problems derived from games and sports show practical activities that are connected to daily living.

Mathematics literacy is highly needed in playing football and following up on football games. According to D'Ambrosio (2009), 'Mathematics literacy is the capability of inferring, proposing hypotheses, and drawing conclusions from data'. Football games provide a lot of data from a number of teams, players and games; the number of wins draws and losses a number of goals scored and goals against. Collating and analysing these raw data would involve frequency counts and the use of basic skills in mathematical operations (addition, subtraction, multiplication and division). 'The knowledge of these Mathematics literacy traits would help anyone; particularly students to read, study, analyse, interpret and prepare Football League Tables (Idehen & Oteze, 2017). Mathematics literacy will help all stakeholders in the football business and activities to handle it expertly. According to Lagrall and Mooney (2002):

> *The processes of describing, representing, analysing and interpreting data. Task analysis of their Mathematics and statistical process or activities would take students through some four statistical levels of thinking: idiosyncratic, transitional, quantitative and qualitative operation.*

Today, Football plays an important role in world culture by promoting healthy competition, sportsmanship, and ethical values and behaviour. Healthy competition and sportsmanship are means of cultivating personal honour, virtue and character. According to Hanson and Savage (2012), sportsmanship is built on the idea that 'sport both demonstrates and encourages character development, which then influences the moral character of the broader community'. Therefore, students playing and watching football games, and monitoring their favourite teams through reading and preparing league tables can have an effect on their personal moral and ethical behaviour outside the competition. Ethics in sports requires four key virtues: fairness, integrity, responsibility, and respect. These virtues are against gamesmanship which is built on the principle that winning is everything as the ends always justify the means. These will influence students' mathematical thinking and ethical values which will make them good sportsmen and sportswomen in learning mathematics and applying mathematical knowledge and problem-solving skills to helping themselves and society.

Various kinds of research have been conducted on mathematical knowledge and skills. Mathematical thinking is the most important part of Mathematics Achievement. According to Stacey (2007), 'Mathematical thinking in solving problems is one of the most fundamental goals of teaching Mathematics.' Through the improving aspects of Mathematical thinking, students will be able to conduct Mathematical investigations by themselves, and they will be able to identify where the mathematics they have learned is applicable in real-world situations. Focusing on the necessities of Mathematical Thinking, Andrew & Alistair (2010), 'stated that it is essential in developing problem-solving skills of students in their life'. Lowe and Muller (2008) asserted that 'mathematical thinking skills are important and should be treated as professional skills'.

Similarly, Lutfiyya, in Binod (2016), defined 'Mathematical thinking as a dynamic process that expands our understanding and involves using mathematically rich thinking skills such as guessing, induction, deduction, specification, generalization, analogy, reasoning and verification'

Football has become a major sport that attracts individuals to participate, market and socialize in the game. According to Gough (2019):

> *1,036,842 American high school boys and 2,237 girls played for their school's football teams in the 2018/2019 school year. In the 2017/2018 school year, of the total 16,616,057 students population the number of boys was 1,036,842(6.24%) and the number of girls was 2,404(1.45%) in the same year.*

In Nigeria, football is one entertainment sport that captures the interest and imagination of about 60% of the population (The Mathematical, 2016), who are mostly youth. On gender, Nematullah, Yousaf, Gulshan & Dad (2015) 'found that the overall performance of male students in Mathematics and its related sciences is better than the females'. Chebet (2016) also asserted 'that there is a significant difference in the participation and performance of males and females in mathematics in favour of males. The purpose of this study, therefore, is to assess students' perception of the use of basic mathematical knowledge and skills in reading, constructing and interpreting football league tables as they relate to gender and playing football.

Research Questions

Three research questions were raised to guide the study as follows:

1. What basic mathematical knowledge and skills do students need to read, construct and interpret the Football League table?
2. Is there any difference between male and female students' mean scores in basic mathematical knowledge and skills in reading, constructing, and interpreting the Football League table?
3. Is there any difference in basic mathematical knowledge and skills in reading, constructing, and interpreting the Football League table between the mean scores of those who play football and those who do not play football?

Hypotheses

The following two hypotheses were formulated and tested at the 0.05 level of significance:

1. There is no significant difference between male and female students' mean scores in basic mathematical knowledge and skills in reading, constructing, and interpreting the Football League table.
2. There is no significant difference between those who play football and those who do not play football mean scores in basic mathematical knowledge and skills in reading, constructing, and interpreting the Football League table.

Method and Materials

The descriptive survey research design was adopted for the study. The population of the study comprised all 34,656 students in public and private senior secondary schools in the 2018/2019 school year in Edo South Senatorial District, Edo State. The simple random sampling technique was used to select one hundred and ninety (190) senior secondary school two (SS2) students from ten (10) schools from five Local Government Areas. Two schools were randomly selected from each of the five Local Government Areas. An arm of the SS2 class was chosen with all the students as participants. 94 male and 96 female students were the respondents, with

129 and 61 of them agreeing and disagreeing that they play football, respectively. The instrument for the study was a 4-point Likert scale on students' Basic mathematical knowledge and skills in reading, constructing and interpreting Football League Table (BMKS). Section A of the instrument sought background information on students' gender, and in addition, they were asked to indicate by ticking either yes or no whether he/she plays football. Thereafter, a table (Appendix A) displaying the Barclays Premier League Football League Table for the 2018/2019 season, as of May 27, 2019 (Sky Sports Football, 2019) was presented for students to study. Section B consisted of 7 items on the BMKS with the options Strongly Agreed (SA), Agreed (A), Disagreed (D), and Strongly Disagreed (SD). Two experts in Mathematics education validated the items in the instrument. The Cronbach-Alpha reliability coefficient of 0.92 was obtained. The instruments were administered by the researchers to students by visiting the sampled schools and classes. In reading the Football League Table, necessary guidance was given when requested by respondents. Response for each item on the instrument was scored 4(SA), 3(A), 2(D) and 1(SD), and thereafter the scores were summed. The data collected were analysed using mean, standard deviation and independent sample t-test statistics. The cut-off mean value for each item was set at 2.5. The hypotheses were tested at the 0.05 level of significance.

Results

Research Question 1: What basic mathematical knowledge and skills do students need to read, construct and interpret Football League Table**?**

Table 1: Mean scores of students in basic mathematical knowledge and skills in reading, constructing, and interpreting Football League Table (n=190)

S/N	ITEMS	Means	SD	Remark
1	I can pair teams against one another to determine the number of games to be played by each team on the football league table.	3.25	0.82	Agreed
2	I can count a number of teams; games played, home games, away games, wins, loses, draws, and goals conceded on the football league table.	3.35	0.69	Agreed
3	I can make some computational skills involving addition and multiplication when calculating goals scored and points earned by teams on the football league table.	3.20	0.85	Agreed
4	I do use relative thinking in collating goals scored minus the goals conceded, or goals for minus goals against on the football league table.	3.18	0.94	Agreed
5	I can provide average goals scored per game, per player, per team, draw and loss per team on the football league table.	3.17	0.83	Agreed
6	I can rank the cumulative points from highest to lowest, goal differentiation, goal differences or goal for on the football league table.	3.37	0.77	Agreed
7	I can demonstrate mathematical and statistical skills for preparing a football league table.	3.40	0.74	Agreed
	Aggregate mean	3.28	0.81	Agreed

Cut-off Mean=2.5

Results from Table 1 show that students could demonstrate the use of mathematical knowledge and skills in preparing a football league table with mean scores ranging between 3.17 and 3.40

and SD of between 0.69 and 0.94. With the mean score value of each item and the grand mean score of 3.275 being more than the cut-off mean of 2.5, the students agreed that mathematical skills and knowledge such as addition, subtraction, multiplication, division, and ordering of numbers are needed in the reading, constructing, and interpreting football league table. Therefore, students need this basic mathematical knowledge and skills in reading and preparing football league tables.

Testing of Hypotheses

Table 2: Descriptive Statistics of Mean Scores for Gender and Playing Football

Variables		N	Mean	Standard Deviation
Gender	Male	94	22.09	3.89
	Female	96	22.85	3.33
Playing Football	Agreed	129	22.83	12.83
	Disagreed	61	21.68	3.67

In Table 2, there are differences between the mean scores of male and female students, and students who agreed and those who disagreed that they play football respectively. To test for significant differences between the two respective means, the t-test statistic was employed. Tables 3 and 4 present the summary of the results of the data analyses.

Hypothesis 1: There is no significant difference between male and female students' mean scores in basic mathematical knowledge and skills in reading, constructing, and interpreting the Football League table.

Table 3: Independent sample t-test of differences in mean Scores of male and female students

Sex	N	Mean	SD	df	t-value	p-value	Remark
Male	94	22.09	3.89	188	-1.43	0.153	Not Significant
Female	96	22.85	3.33				

Table 3 show a t-value of -1.43 and a p-value of 0.153. Therefore, the null hypothesis is retained ($p>0.05$). The result indicates that there is no significant difference in the mean scores of male and female students in basic mathematical knowledge and skills in reading, constructing, and interpreting the Football League table.

Hypothesis 2: There is no significant difference between those who play football and those who do not play football mean scores in basic mathematical knowledge and skills in reading, constructing, and interpreting the Football League table.

Table 4: Independent sample t-test of differences in mean scores of students who play football and those who do not play.

Playing Football	N	Means	SD	df	t-cal	p-value	Remark
Agreed	129	22.83	12.33	188	2.04	0.043	Significant
Disagreed	61	21.68	3.67				

Table 4 show a t-value of 2.04 and a p-value of 0.043. Therefore, the null hypothesis is rejected ($p<0.05$). The result indicates that there is a significant difference in the mean scores in basic mathematical knowledge and skills in reading, constructing, and interpreting the Football League Table of students who play football and those who do not play football.

Discussion of Results

Results from research question one revealed that students need basic mathematical knowledge and skills in preparing a football league table. It thus revealed that students can count the number of teams; games played, home games, away games, wins, loses, draws, and goals conceded on the football league table. It further revealed that students can make some computational skills involving addition, subtraction, multiplication and division when calculating for goals scored and points earned by teams on a football league table. It revealed further that students use relative thinking in collating goals scored minus the goals conceded, or goals for minus goals against; and that students can calculate average goals scored per game, per player, per team, draw and lose per team. In addition, the finding revealed that Students can rank the cumulative points from highest to lowest, goal differentiation, goal differences or goal for on the football league table. Furthermore, it revealed that students can pair teams against one another to determine the number of games to be played by each team. The results showed that mathematical skills and knowledge such as addition, subtraction, multiplication, division and ordering of numbers are needed in reading, constructing, and interpreting football league tables. These findings are supported by Stacey (2007) and Lowe and Muller (2008) who asserted that mathematical knowledge and thinking skills are important to individuals in solving problems.

The result from the analysis and testing of hypothesis one revealed that there was no significant difference in the mean scores of male and female students in basic mathematical skills in reading, constructing, and interpreting the Football League table. This result is contrary to Chebet (2016) that asserted that there is a significant difference in the performance of male and female students in mathematics.

The result from the analysis and testing of hypothesis two revealed that there was a significant difference in the mean scores of the students in basic mathematical knowledge and skills in reading, constructing, and interpreting the Football League Table by those who play football and those who do not play football in favour of students who play football.

Ethical implications

Football sportsmanship would promote the virtues of fairness, integrity, responsibility, and respect. Therefore, football culture and healthy competition in sports can have an effect on students' moral and ethical behaviour within and outside the classroom by cultivating in them personal honour, virtue and character in mathematics learning and its applications to real-life situations.

Conclusion

Application of basic mathematical knowledge and skills in reading and preparing football league tables relates the teaching and learning of mathematics to real-life situations. This generates students' interest in learning mathematics and promotes ethical values in the applications of mathematical knowledge and skills in solving personal and societal problems.

Recommendations

To develop students' mathematical knowledge and skills, the following recommendations are made:

1. Primary and secondary school mathematics curricular contents should be linked to football games and league tables. This would relate the teaching and learning of mathematics to real-life situations, serve as enrichment content and make the learning of the subject popular among students.

2. As playing football has an influence on the application of mathematical knowledge and skills, equitable access of all students to sports facilities and participation in sports should be encouraged and promoted by teachers, school administrators, parents, governments and other stakeholders in mathematics education.

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Appendix A

Premier League Table 2018/19									
S/N	Team	Pl	W	D	L	F	A	GD	Pts
1	Manchester City	38	32	2	4\	95	23	72	98
2	Liverpool	38	30	7	1	89	22	67	97
3	Chelsea	38	21	9	8	63	39	24	72
4	Tottenham Hotspur	38	23	2	13	67	39	28	71
5	Arsenal	38	21	7	10	73	51	22	70
6	Manchester United	38	19	9	10	65	54	11	66
7	Wolverhampton Wanderers	38	16	9	13	47	46	1	57
8	Everton	38	15	9	14	54	46	8	54
9	Leicester City	38	15	7	16	51	48	3	52
10	West Ham United	38	15	7	16	52	55	-3	52
11	Watford	38	14	8	16	52	59	-7	50
12	Crystal Palace	38	14	7	17	51	53	-2	49
13	Newcastle United	38	12	9	17	42	48	-6	45
14	Bournemouth	38	13	6	19	56	70	-14	45
15	Burnley	38	11	7	20	45	68	-23	40
16	Southampton	38	9	12	17	45	65	-20	39
17	Brighton and Hove Albion	38	9	9	20	35	60	-25	36
18	Cardiff City	38	10	4	24	34	69	-35	34
19	Fulham	38	7	5	26	34	81	-47	26
20	Huddersfield Town	38	3	7	28	22	76	-54	16

Retrieved on: May 27, 2019.