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Preparation of Football League Table and School Mathematics Teaching and Learning

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Abstract. The purpose of this study was to assess preservice mathematics teachers' use of mathematical knowledge and skills to read, prepare and interpret football league table. The study combined both quantitative (performance test and questionnaire instrument) and qualitative (semi-structured interview instrument) methods. The research data were collected from 43 undergraduate preservice mathematics teachers. The instruments for the study were the Basic Mathematical knowledge and skills (BMFLT) test and the Semi-structured Interview (SSI) guide on reading, preparing and interpreting football league table. Six research questions were raised to guide the study and two of them were hypothesized. Frequencies, percentages, mean and standard deviation were used to answer the research questions and the t-test statistic was used to test the hypotheses. Results show that the level of performance of preservice mathematics teachers is high in the four mathematical areas of reading, solving problems, making inferences from and preparing football league table. That counting, addition, subtraction, multiplication and division are basic mathematical knowledge and skills needed by preservice mathematics teachers in reading, preparing and interpreting football league table. There is no significant difference between the mean performance scores of male and female teachers and those who play and do not play football. The study concludes that the football league table is perceived by the preservice mathematics teachers to be relevant and valuable to school mathematics teaching practices. It is recommended that student centered culturally responsive mathematics teachers' development programme and teaching methods/strategies should be promoted through the application of real life situations and examples.

Keywords: Mathematics Teachers' Assessment, Basic Mathematical Knowledge and Skills, Preparation of Football League Table, Culturally Responsive Mathematics Education

1. Introduction

School Mathematics is a universally acknowledged body of mathematics knowledge in content and methodology. The current school mathematics practices in Nigeria are based on unified curricula with well-defined content and method of teaching (Federal Ministry of Education, 1977; Nigerian Educational Research and Development Council, 2012a, 2012b, Idehen, 2019). The curriculum for each of primary and secondary levels has been developed entirely to include those mathematical concepts and topics every child should know in order to function satisfactorily as a citizen. The curriculum guide therefore specifies topics, objectives, contents, teacher/students' activities, teaching and learning materials and evaluation guide. The curriculum guide suggests such methods that meet the requirement of up-to-date psychology and didactics (Badmus, 1997, Idehen, 2019) and that topic in mathematics are taught to reflect Nigerian culture by making use of locally resource materials and examples. The curricula are guide to teachers and not therefore to be fast in nature as moderation and changes are allowed to suite individual differences and culture.

Recent trend in teaching and learning of mathematics worldwide demands a conceptual change approach as against the traditional didactic method, which promotes rote memorization and thereby distancing school mathematics contents and learning from the cultural and everyday living of the child. Mathematics is everywhere and as it is experienced and practiced by every culture, scholars like D'Ambrosio (1988, 2007 & 2018), Rose and Orey (2011), Brandt and Chernoff (2014) and Furuto(2016) recommend ethnomathematics education that helps students make and find hands-on

connections to the school mathematics curriculum through their cultural and historical backgrounds. On this wise, D'Ambrosio (2018) conceptualized ethnomathematics programme as the "evolution of ideas, of practices and of knowledge in the human species in different cultural environments" p.231. Earlier, D'Ambrosio (1988) has simply defined ethnomathematics as the "mathematics of the identifiable cultural group, developed from quantitative and qualitative practices such as counting, weighing, sorting, measuring and comparing" p.5. Ethnomathematics education implies an analysis of how the school (students and teachers) generated ways, styles, arts and techniques of doing and knowing mathematics, of learning and explaining mathematics, and of use of mathematical knowledge and skills in dealing with situations and of solving problems of their natural and socio-cultural environment. For mathematics education to foster a greater understanding of how mathematics is applied in our increasingly technologically driven and globalized world, Brandt and Chernoff contend that school mathematics needs to expand its parameters and become more inclusive of the mathematics found in the world that students inhabit. Hence, mathematics education should reflect and embrace the cultural diversity of our classrooms and of our increasingly interconnected world, through ethnomathematics which has the potential to show our students' multicultural views of mathematics that may help students develop a greater interest in school mathematics.

From the forgoing, ethnomathematics education encourages the connection of school mathematics to culture and culture to school mathematics. Rosa and Orey (2011) stated that, when students come to school they bring with them values, norms, and concepts they have acquired in their socio-cultural environment some of which are mathematical in nature. Therefore, to teach and learn school mathematics, Mukhopadhyay, Powell, and Frankenstein (2009), Barta and Brenner (2009) and Gay (2009) examined and proposed a culturally responsive mathematics education. For mathematics teachers to be culturally responsive and effective, Gay proposed a programme for preparing mathematics teachers to "acquire new knowledge, attitudes, belief, and skills about self, students, subject matter, teaching and learning" p.189. Thus, both teachers in training and those already in service should learn about culturally responsive teaching (CRT) in ways similar to the ones they should use with students in their own classroom. Culturally responsive teaching takes the position that all mathematics knowledge is socially constructed, and teachers need to understand how mathematics is a cultural construction, and how this construction can help to demystify school mathematics teaching and learning. The CRT, according to Parsons, as cited in Gay(2009), helps the teacher to "culturalize" mathematics instruction by deliberately enacting culturally diverse values, information, and resources to change the contexts and content of learning to improve academic outcomes. Furuto(2016) called the CRT strength-based approaches in designing and implementing ethnomathematics education research in the professional development of educators and teacher educators. This is accomplished by honouring culturally responsive, place-based strategies such as learning within and outside of the classroom and reshaping the curriculum in a cultural context.

Football is a popular game with large followership among youth worldwide. Through the UEFA.com (2021), the UEFA President, Ceferin said: "Football is a social and cultural treasure, enriched with values, traditions and emotions shared across our continent(s)". In Nigeria, football is one entertainment sport that captures the interest and imagination of about 60% of the population (The Mathematical, 2016). There is a growing football culture among Nigerian students who are avowed fans and supporters of local and international football clubs; who will spend valuable time and money to play or watch live football matches at stadium or on television. Mathematical knowledge and skills are involved in playing football and following football matches by reading, preparing and interpretating football league tables. Connecting preparation and interpretation of football league tables and school mathematics teaching and learning will allow or encourage students to construct mathematical knowledge and skills that will make them count on who they are and what they know. The use of football cultural references and examples in mathematics classrooms increases as teachers begin to see the value of framing the mathematics they teach in a context with which the students are familiar (Lipka, 1998). According to Barta and Brenner (2009), such integrations work to validate local knowledge and mathematical applications implemented within the student's community that are typically omitted from school mathematics curricular inclusion.

However, Unodiaku (2013) faulted the teaching and learning of mathematics across secondary schools in Nigeria as the mathematics teachers are inclined to the traditional rote learning of mathematics and the use of teaching materials that are alien to the students' cultural background. Earlier, Kurumeh (2007) had observed that the poor performance of students in

Mathematics, particularly in geometry and mensuration, might have been due to the inability of students to understand the basic mathematical concepts, principles, computations or logical facts involved and the underlying processes that gave rise to the mathematical facts or concepts. Kurumeh concluded that this resulted from the "type of inappropriate, inadequate, foreign, elitist and eurocentric teaching techniques and methods used by mathematics teachers" p.104. Unodiaku and Kurumeh severally, based on their findings, recommend that ethnomathematics teaching materials and approach should be incorporated in the school mathematics curriculum and classroom practices. The instruction that integrates ethnomathematical dimensions in preparing and interpreting football league tables and school mathematics reflects a shift in the educational status quo which typically occurs in the mathematics classrooms. It will help students grow to have more interest in learning mathematics and be successful in using mathematical knowledge and skills; and will help teachers to connect teaching mathematics and football culture. The need for mathematics teachers to examine how different mathematics subject matter concepts, content, and skills in the football cultural practices of students will influence school mathematics curriculum has informed this study. The study was guided by the following research questions:

(i) What percentage of preservice Mathematics teachers identifies the right basic mathematical knowledge and skills for reading, preparing and interpreting football league tables?
(ii) What basic mathematical knowledge and skills do preservice Mathematics teachers need to read, prepare and interpret football league tables?
(iii) What is the level of performance of preservice mathematics teachers in the areas of reading, solving mathematical problems, making inferences and preparing football league table?
(iv) To what extent do preservice mathematics teachers perceive that reading, preparing and interpreting football league tables will be relevant to their teaching practices?
(v) What is the difference in the mean performance scores of preservice mathematics teachers in reading, preparing and interpreting football league table based on gender?
(vi) What is the difference in the mean performance scores of preservice mathematics teachers who play football and those who do not play in reading, preparing and interpreting football league table?

Research questions 5 and 6 were hypothesized as follows:

HO1: There is no significant difference in the mean performance scores of male and female preservice mathematics teachers in reading, preparing and interpreting football league table.
HO2: There is no significant difference in the mean performance scores of preservice mathematics teachers who play football and those who do not in reading, preparing and interpreting football league table.

2. Literature Review

Current efforts in Mathematics education are to orient teachers to discover pathways for student engagement, and support multiple approaches to teaching and learning mathematics within formal and informal environments. To effectively accomplish this, Furuto (2016) examined strengths-based approaches in ethnomathematics research in the design and implementation of professional development for educators and teacher educators, by honouring culturally responsive, place-based strategies such as learning within and outside of the classroom and reshaping the curriculum. Placed-based strategies, according to Furuto, recognize the importance of including students' cultural contexts in all aspects of learning, as the expertise that exists in our communities, schools and families is the foundation in the production of knowledge for empowerment to achieve equitable and quality mathematics education. Towards this end, Furuto conducted a research with the support of the Ethnomathematics and STEM Institute (EthnoSTEM) at the University of Hawai`i - West O`ahu. The Ethnomathematics Institute was a two-week summer programme for 39 undergraduate P-20 STEM teachers for the years 2013-2015, to address issues of equitable and quality education through culturally responsive STEM pedagogy. During the yearlong EthnoSTEM institute, participants met four times face-to-face (with sessions lasting from one to seven days) and once online, for a total of 132 direct contact hours over 13 days. The professional development structure consists of a two-day intensive orientation focused on introducing and laying the foundation and building community, three one-day workshops centered around themes that expose the teachers to different ethnomathematics promising practices and strategies through field experiences, and a one-week summer institute. The evaluation of

EthnoSTEM utilizes a mixed-methods approach, and evaluators use instruments for collecting formative and summative information. The main methods of data collection are observations, surveys, focus group interviews, and reflections after every professional development component. The analyses consist of descriptive statistics for quantitative data and qualitative analysis using a grounded theory approach for constructed-response questions. Overall, the participants perceived the professional development experience to be valuable and relevant to their teaching practice. When asked to give examples of how their teaching practices have changed, most participants indicated that the professional development programme encouraged them to modify curriculum materials to make them more relevant to their students through cultural activities and placed-based connections. As the teachers view of mathematics is transmitted to the students in their instruction, and this will shape students' views about the nature of mathematics of being culture based, culturally responsive place-based strategies will help to include football cultural contexts in learning mathematics in Nigeria schools.

One of the aims of teaching and learning mathematics is to encourage and enable learners to become confident in using mathematical knowledge and skills to analyze and solve practical problems in real life situations. Mazana, Montero and Casmir (2020) assessed Tanzanian teachers' perspective on students' performance in Mathematics by analysing mathematics performance data obtained from the National Examination Council of Tanzania during the period 2008 to 2016. The study further examined the perception of teachers on the causes of poor academic performance in mathematics among students in Tanzania. Their findings revealed, among others, higher failure rates in mathematics in secondary schools particularly in lower secondary schools. Those factors associated with students' poor performance are in line with Walberg's Productivity model (which includes students aptitude attributes, instructional factors and social psychological environment) but for Tanzania policy, environment and culture play much important roles. The findings revealed that majority of the teachers possessed mixed emotions towards student's ability and the teaching-learning environment. Specifically, on teachers' perception on factors influencing students' performance in mathematics, the study revealed that teachers' attitude towards students and mathematics affect their students' attitude towards mathematics and performance. These teachers believe that mathematics is being taught as an abstract subject in such a way that students do not see the value of the subject in real life applications. On measures to improve the situations, the researchers suggested enhancement in teaching-learning environments, classroom instructions, teaching skills and students learning skills, teacher training programmes, attitude of the community, and accountability. The results from this study provide information about the trends of school mathematics achievement and associated factors for teachers' educators and other stakeholders to consider the implications in Curriculum and Instructional practices of mathematics at all levels of education, particularly in linking the teaching of mathematics with the student's real life experiences.

Idehen and Oteze (2020) assessed the perception of 108 secondary school teachers of their students' use of basic mathematical knowledge and skills in reading, preparing and interpreting football league tables. The descriptive survey design was employed to select a total of 108 secondary school teachers from 25 schools across Edo and Delta states of Nigeria. The instrument for the study was a 4-point Likert scale on needed basic mathematical knowledge and skills by students in reading, preparing and interpreting football league table. The findings showed that the teachers perceived basic mathematical knowledge and skills such as counting, addition, subtraction, multiplication, division and ordering of numbers are needed by students to read, prepare and interpret football league table. The findings also shows that teachers perceived that mathematical knowledge and skills descriptors within four thinking levels (idiosyncratic, translational, quantitative and analytical) are highly used by students in demonstration of awareness, identification/interpretation of unit score, summative grouping of data, comparison of data and teams, evaluation of displayed data, relative thinking and construction of league table in the preparation of football league table. Furthermore, the study found a significant difference between the mean scores of teachers who play football and those who do not play football on students' mathematical knowledge and skills needed to read, prepare and interpret football league table in favour of those teachers who play football. Idehen and Oteze therefore recommended that to connect classroom mathematics to students' daily experience and social lives, Nigerian teachers are encouraged to have the right perception of their students' mathematical knowledge and skills dispositions through personal assessment.

Reid and Reid (2017) examined critically the mathematics content knowledge (MKC) of 151 teacher candidates enrolled in a two-year Master of Teaching degree in Ontario, Canada. The study

analysed the basic numeracy skills of the teacher candidates through pre- and post-tests. In addition, 8 teacher candidates took part in semi-structured interviews and shared their experiences in the Master programme. Test results indicated significant improvements in many basic mathematics concepts and skills of addition, subtraction, multiplication, division, fractions, percent, decimals, ratios, order of operations, and integers. Interview results revealed teacher candidates' perceptions of mathematics test, courses, and instructors, as well as the importance of teaching mathematics during their practicum placement. The researchers recommended that teacher education programmes establish minimum mathematics competency standards, enhance coherence between mathematics courses and practicum placements, and providing additional support for teacher candidates with low mathematics proficiency.

On teachers' mathematical knowledge for teaching and the mathematical quality of instruction, Hill, Blunk, Charalambos, Lewis, Phelps, Sleep and Ball (2008) studied both the mathematical knowledge that is common to individuals working in diverse professions and the mathematical knowledge that specialized to teaching. The researchers used a series of five case studies and associated qualitative data to detail how mathematical knowledge for teaching was associated with mathematical quality of instruction. Results from the study indicated some significant strong association between levels of mathematical quality of instruction. Also, Gencturk (2012) dissertation examined the relationship among teachers' mathematical knowledge, their teaching practices, and student achievement. Quantitative and qualitative data collection techniques (content knowledge assessments, surveys, interviews, and classroom observations) were used to collect data from 21 inservice masters' programme teachers and 873 students. The 21 teachers were followed for 4 years to study how their mathematical knowledge as well as their teaching practices change over time. The results indicated that, compared with their initial baseline data, teachers' mathematical knowledge increased dramatically, and the teachers made statistically significant changes in their classroom design, mathematical agenda of the lessons, task choices and classroom climate. The gains in the teachers' mathematical knowledge predicted changes in the quality of their lesson design, mathematical agenda and classroom climate. Teachers' beliefs were related to the quality of their lesson design, mathematical agenda, and quality of task chosen.

Focusing on teachers' mathematical knowledge for teaching and quality of instruction, the present Study differs from others which examined inservice undergraduate teachers' professional development through summer institute/programme and workshops (Furuto, 2016) and case studies (Hill etal, 2008) to expose teachers to different teaching strategies and practices as well as from other studies which investigated mathematics content knowledge through pre- tests and post-tests (Reid & Reid, 2017; Gencturk, 2012). Though Idehen and Oteze(2020) study assessed the perception of secondary school teachers of their students' use of basic mathematical knowledge and skills in reading, preparing and interpreting football league table, this study went further to assess undergraduate preservice mathematics teachers' use of basic mathematical knowledge and skills in reading, preparing and interpreting football league table. In addition, Idehen and Oteze's used Quantitative (questionnaire) method to collect data, on the other hand, the present study employed quantitative (performance test and questionnaire) and qualitative (semi-structured instrument) methods to collect data. This study used mixed methods to assess undergraduate preservice mathematics teachers' basic mathematical knowledge and skills using football league table to establish the need for a Culturally responsive mathematics education through linking the teaching of school mathematics with the students' real life experiences.

3. Theoretical Frameworks

The theoretical frameworks that informed this study is drawn from Aguirre's (2009) conceptual frame on Teaching mathematics for equity and social justice: Theoretical framework for mathematics teacher education. The researcher uses the framework suggested by Gustien (2006) that aims for a balance among classical knowledge (school mathematics), cultural knowledge and critical knowledge that will facilitate the students' development of three knowledge bases and their interrelationships (see figure 1). Also, the framework is about impacting teacher cognition (e.g., beliefs, knowledge, goals) that, in turn, impact instructional practice.

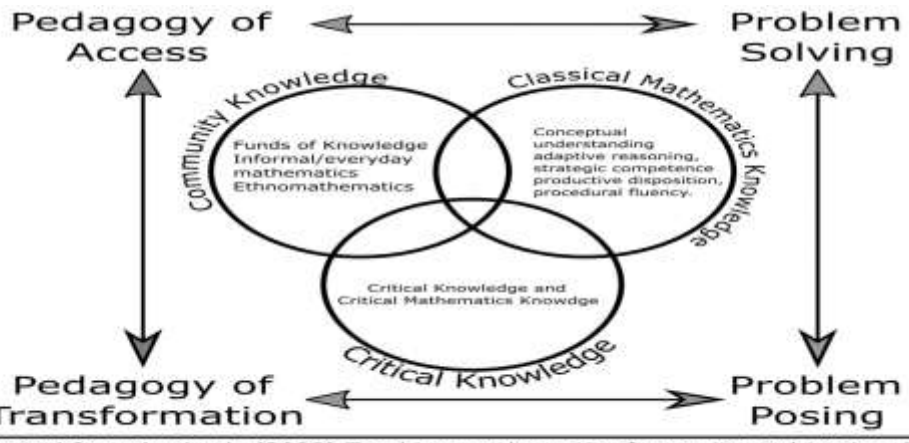

Figure 1: Adopted from Aguirre's (2009) Teaching mathematics for equity and justice: Theoretical framework for mathematics teacher education

From the teaching of Mathematics for equity and social justice theoretical framework for mathematics teacher education, Aguirre defines classical mathematics knowledge as referring to the mathematical power and competencies needed to make meaning in the world, pass gate-keeping educational and vocational tests, and pursue advanced mathematics and mathematics-related careers. These include the academic content and strands of mathematical proficiency of school mathematics curriculum as developed by the Nigerian Research and Development Council (NERDC) (2012a; 2012b) for primary and secondary schools in Nigeria. It is important for in-service teachers to develop and assess a strong sense of what Mathematics ideas, concepts, principles and operations in the preparation and interpretation of football league table are expected to advance students in our schools. Community knowledge refers to the universal capacity of "ordinary" people to have and produce knowledge about their lives, experiences, and context. It includes the funds of knowledge that underline household exchanges, traditions, and activities; it also includes the production of mathematical knowledge that undergirds everyday such as gardening, sewing, buying and selling. The fans, supporters, players and coaches, owners and sponsors of football clubs have a community of mathematical knowledge which they produce and use in recording match scores, read, prepare and interpret football league tables. By focusing attention on football community knowledge and the mathematical knowledge produced from the community, mathematics teachers develop a sense that there are mathematical resources (rather than barriers) to be mined from the football community that can produce productive dispositions, rich mathematical discussions, and learning for students. The term critical knowledge refers to the mathematical knowledge required to analyze the power relations, social injustices, and iniquities that affect our individual, community, and global lives. It is the knowledge needed beyond mathematics to understand various sociopolitical contexts, including multiple histories, policies, institutional structures, and practices that create equity and iniquity in our world. For mathematics teachers, it is a new idea to acknowledge that school mathematics has an important role in analyzing football game issues that impact the world of football. By introducing critical football knowledge as part of a knowledge triumvirate that connect to school mathematics, it opens a door that transcends mathematics beyond the curriculum guidelines, content standards and textbook.

To facilitate the students' development of all three knowledge bases and their interrelationships, Aguirre added two spectrums designed to highlight important dimensions critical to teaching mathematics for social justice that respects the dual emphasis on both equity and mathematics. The left side of the theoretical framework focuses on the Access-Transformation Pedagogy Spectrum that highlights access at one end and transformation at the other. The focus on access is to create learning opportunities for all students to engage in rich mathematical discourse and practices rather than perpetuating a uniform school curricular tracking that relegates other students from same cultural, ethical/racial, and linguistic group to general mathematics contents. Hence, for this study the Access-Transformation Pedagogy Spectrum when acknowledged and used by teachers will empower students to use mathematical knowledge and skills to prepare, interpret and analyze football league tables. The right side of the schematic representation of the knowledge bases focuses on the Problem Solving/Problem Posing Pedagogy Spectrum.

Problem Solving has been a key component of reconceptualizing mathematics beyond procedural fluency by including adaptive reasoning and strategic competence as elements of problem solving crucial to mathematics proficiency (National Research Council, 2001). In this framework, problem solving parallels classical mathematics knowledge to acknowledge that relationship. Using scores from football matches to prepare and analyze league tables and to teach problem solving is both challenging and rewarding task for teachers because it pushes teachers to anticipate the implications of various students approaches to school mathematics problems and determine if those approaches are potentially fruitful and if not how to help make them so. This study uses a problem-posing/ Problem-solving approach on preparing and interpreting football league tables that embraces the community of football mathematical knowledge, classical school mathematics knowledge and critical mathematics knowledge necessary to analyze the global football world within contexts and relate that knowledge to the school curriculum.

4. Methodology

This study employed both quantitative (performance test and questionnaire instrument) and qualitative (semi-structured interview instrument) methods. The performance and questionnaire instrument were used to assess 43 undergraduate preservice mathematics teachers' knowledge and perception of using basic mathematical knowledge and skills in reading, preparing and interpreting football league table (BMFLT). These undergraduate preservice mathematics teachers had been formally taught school mathematics and were in the final year (400 Level) of their B.Sc (Ed) Mathematics programme at a Federal university in Edo State, Nigeria.. All the 48 students enrolled in the programme were the target population, but two of them were absent and three who participated in the test but did not provide answers to all the items were excluded. Table 1 shows the characteristics of the 43 candidates who participated in the test.

Table 1: Preservice Mathematics Teachers' Characteristics (N = 43).

Variable	Level	Number of Respondents	Percentage (%)
Gender	Male	31	72.09%
	Female	12	27.91%
Play football	Yes	25	58.14%
	No	18	41.86%

Table 1 displays the data on the characteristics of the 43 preservice mathematics teachers who participated in the study. The characteristics by gender shows more male (72.09%) than female (27.91%) participated. On play football variable, more of those who play football (58.14%) than those who do not play (41.86%) participated. Thus, the candidates for the performance test were able to provide relevant information for the study as they have had two 6 weeks (12 weeks altogether) of supervised teaching practice exercises in their 300 and 400 levels in the 2018/2019 and 2019/ 2020 academic sessions. The preservice mathematics teachers participated voluntarily and their identity kept confidential.

The BMFLT instrument was divided into 8 sections: A, B, C, D, E, F, G and H. Section A was to provide biographical data on gender of student (male and female) and play football (yes or no) variables; Section B had 8 items on reading a presented Football League Table (FLT); C had 8 items on solving problems using the FLT; D had 8 items on making inferences from the FLT; E had 5 items on preparing FLT; F had 10 items on identifying the basic mathematical knowledge and skills used in reading, preparing and interpreting FLT; and H had 9 items Likert like questionnaire meant to elicit teachers' perception on use of basic mathematical knowledge and skills in reading, preparing and interpreting the FLT. The 32 items in sections B, C, D and E were of objective test with 4 options (a, b, c, d). The candidate was to choose one of the options as his/her answer to any of the questions. Each of the items in section F was scored 4 (strongly agreed), 3 (agreed), 2 (disagreed) and 1 (strongly disagreed).

The qualitative instrument had 8 semi-structured interview questions that provided data on preservice mathematics teachers' personal views on using basic mathematics knowledge and skills in reading, preparing and interpreting football league tables and it connections to school mathematics curriculum that will reflect culturally responsive mathematics education. All interviews were guided by an interview guide. The interview guide consisted of 8 questions that are described in Table 2.

Table 2: Structured interview guide

	Question	Description
1	What school mathematical concepts can be taught to students in reading football league tables?	This question aimed at listing the basic mathematical concepts that can be used in reading football league table
2	What mathematical skills can be taught students in preparing football league tables?	The question aimed at finding the basic mathematical skills that can be used in preparing football league table.
3	How can you integrate the preparation and interpretation of football league tables into school mathematics curriculum?	The question aimed at first knowing the basic mathematical concepts and skills that can be included as content in school mathematics; second, at what level they can be included; and third what method can be applied to teach them.
4	How can connecting preparation and interpretation of football league table increase the interest of students in learning mathematics?	The question aimed at knowing whether the interest students have playing and watching football league games can be transferred positively to learning school mathematics.
5	How can connecting mathematics to football league table change the attitude of students toward school mathematics?	The question aimed at knowing whether the attitude students have toward learning mathematics can be influenced by their attitude towards football games.
6	As a pre-service teacher how will this connection between preparation of football league tables and school mathematics change your teaching methods/strategies?	The question aimed at finding how teachers can connect real life situations to school mathematics contents and classroom practices.
7	How can football cultural references and examples in mathematics help the students?	The question aimed at knowing if connecting mathematics to cultural contexts will help them realize that mathematics contents are culturally based.
8	How does relating mathematics to football or football to mathematics promote a culturally responsive mathematical education?	The question aimed at knowing whether teachers can change to relevant culturally responsive instructional approaches that would change the contexts and content of school mathematics as to improve academic outcomes.

Two experts in mathematics education and who had taught school mathematics validated the items in the BMFLT instrument. The instrument was administered on the candidates after allowing them to study the league table (see Appendix A) for about 40 minutes. The instructions on the various sections of the instrument were explained and candidates were given opportunity to ask questions for further clarification. Some candidates raised questions on the modalities and steps on reading and preparing football league tables. The question-and-answer sessions were handled discreetly so as not to preempt answers to the questions raised in the BMFLT instrument. It was not necessarily a speeded test but candidates completed the questions between one and one-half hours. For the semi-structured interview, the researcher personally interviewed the candidates one after the other. Each candidate wrote down their responses to each of the 8 questions. Prompting questions were asked by the researcher and explanations/clarification of responses were given by the candidates, where necessary, which were carefully noted down.

The study ultilised score data collected from the BMFLT on the 43 preservice teachers' knowledge and perception. The maximum score for answers to questions in each of sections B, C, D and E was 8 marks respectively, totally 32 marks. The performance score data were analysed using the following descriptive statistics: frequencies, percentages, mean and standard deviation. Percentages were used to answer research questions one and two to identify the right basic mathematical knowledge and skills (counting, addition, subtraction, multiplication and division) of the ten descriptors of the league table (total number of teams, total number of games, total goals scored, total points earned, total games won, total games lost, total goals against, total number of draws, goal difference and average goal scored). To answer research question three, the levels of performance for each of the mathematics areas of reading, solving problems, making inferences and preparing the FLT were set at 0.0 - 2.0 (very low), 2.0 - 4.0 (low), 4.0 - 6.0 (high) and 6.0 - 8.0 (very high). For the sum of the data from sections B, C, D and E the levels of performance were set at 0.0 - 8.0 (very low), 8.0 - 16.0 (low), 16.0 - 24.0 (high) and 24.0 - 32.0 (very high). To answer research question six, the levels of performance were set at 0.0 - 2.66 (low), 2.66 - 5.32 (moderate) and 5.32 - 8.00 (high). The t - test statistic was used to test, at the 0.05 level of significance, the difference between the mean performance scores of male and female participants, and those who play football and those who do not play. The qualitative data were coded and reviewed and validated by two experts in Mathematics education and test measurement and evaluation.

5. Findings

Results are presented by use of tables. Results from table 3 will be used to answer research questions 1 and 2.

Research Question 1: What percentage of preservice mathematics teachers identifies the right basic mathematical knowledge and skills for reading, preparing and interpreting football league table?

Table 3: Preservice mathematics teachers' identification of five basic mathematical knowledge and skills for reading, preparing and interpreting football league table (N= 43).

S/N	Descriptors	Counting	Addition	Subtraction	Multiplication	Division	Decision
1	Total number of teams	41 (95.3%)	31 (72.1%)	00 (0.0%)	01 (2.3%)	01 (2.3%)	Counting Addition
2	Total number of games	29 (67.4%)	38 (88.4%)	05 (11.6%)	01 (2.3%)	01 (2.3%)	Counting Addition
3	Total goals scored	27 (62.8%)	40 (93.0%)	07 (16.3%)	04 (9.3%)	00 (0.0%)	Counting Addition
4	Total points earned	18 (41.9%)	37 (86.0%)	10 (23.1%)	08 (18.6%)	02 (4.7%)	Counting Addition Multiplication
5	Total games won	27 (62.8%)	37 (86.0%)	06 (14.0%)	04 (9.3%)	01 (2.3%)	Counting Addition
6	Total number of games lost	29 (67.4%)	29 (67.4%)	20 (46.5%)	00 (0.0%)	00 (0.0%)	Counting Addition Subtraction
7	Total number of goals against	23 (53.5%)	31 (72.1%)	19 (44.2%)	02 (4.7%)	03 (7.0%)	Counting Addition Subtraction
8	Total number of draws	30 (69.8%)	34 (79.1%)	12 (27.9%)	03 (7.0%)	00 (0.0%)	Counting Addition
9	Goal difference	15 (34.9%)	24 (55.8%)	32 (74.4%)	02 (4.7%)	02 (4.7%)	Counting Addition Subtraction
10	Average goal scored	16 (37.2%)	33 (76.7%)	04 (9.3%)	08 (18.6%)	30 (68.8%)	Counting Addition Divison

Table 3 displays ten football table mathematics knowledge descriptors: total number of teams; total number of games; total goals scored; total points earned; total number of games won; total number of games lost; total number of goals against; total number of draws; goal difference, and average goal scored. Also, Table 3 displays five basic mathematical knowledge and skills (counting, addition, subtraction, multiplication and division) for calculating for each of the ten football table knowledge descriptors. The results show that between 34.9% to 95.3% of the preservice mathematics teachers rightly identified counting as being used in calculating for the ten descriptors in reading, preparing and interpreting football league table. The highest (95.3%) of them used counting to calculate for the total number of teams and with least (34.9%) for goal difference. Furthermore, 55.8% to 93.0% of them rightly identified addition to calculate for the ten descriptors; while 44.2% to 74.4% rightly identified subtraction for calculating the total number of games lost, goals against and goal difference; 18.6% identified multiplication for total points earned; and 69.3% identified division for calculating for average goal scored.

Research Question 2: What basic mathematical knowledge and skills do preservice mathematics teachers need to read, prepare and interpret football league table?

From Table 3 and the discussion that follows, counting and addition were used by the preservice mathematics teachers to calculate for all the ten descriptors; subtraction for three descriptors (total number of games lost, goal against, and goal difference); multiplication for total points earned and division for average goal scored. Thus, counting and addition are the most used mathematical knowledge and skills in reading, preparing and interpreting football league table. Therefore, counting, addition, subtraction, multiplication and division are the basic mathematical knowledge and skills needed in reading, preparing and interpreting football league table.

Research Question 3: What is the level of performance of preservice mathematics teachers in the areas of reading, solving mathematical problems, making inferences and preparing football league table?

Table 4: Level of performance of preservice mathematics teachers in the four mathematics areas (N = 43)

	Mathematics Areas	Maximum Score	Mean	SD	Performance Level
1	Reading FLT	8	6.93	1.39	Very High
2	Solving problems using FLT	8	5.65	1.55	High
3	Making inferences from FLT	8	5.84	1.78	High
4	Preparing FLT	8	4.8	2.55	High
	Total	**32**	**23.22**	**7.27**	**High**

Table 4 displays the mean and standard deviation (SD) for the four mathematics areas of reading football league table (FLT), solving problems using FLT, making inferences from FLT, and preparing FLT. The level of performance of the 43 preservice mathematics teachers of reading FLT is very high (mean = 6.93). It is high for the teachers in solving problems using FLT (mean = 5.65), making inferences from FLT (mean=5.84) and preparing FLT (mean=4.80). In the overall performance of the preservice mathematics teachers, the level of performance is high (mean = 23.23). Therefore, the level of performance of preservice mathematics teachers is high in reading, preparing and interpreting football league table.

Research Question 4: To what extent do preservice mathematics teachers perceive that reading, preparing and interpreting football league tables will be relevant to their teaching practices?

Table 5: Understanding, modification, incorporation and relevance of reading, preparing and interpreting of football league table to school mathematics teaching practices (N=43)

S/N	Question	Construct	N	Mean	SD
1	Football League Table (FLT) has helped me to better my understanding of basic mathematics operation concepts (addition, subtraction, multiplication and division)	Understanding of basic mathematics operation	43	3.65	0.68
2	The reading, preparation and interpretation of FLT will encourage me to modify curriculum contents and materials to make them more relevant to student through cultural activities.	Modification of curriculum contents and materials	43	3.33	0.52
3	Reading, preparation and interpretation of FLT helped me to better my understanding of culturally responsive mathematics education.	Understanding of culturally responsive mathematics education	43	3.3	0.63
4	The FLT helped me to understanding how to incorporate culturally responsive mathematics contents into my teaching practice.	Incorporation of culturally responsive mathematics content	43	3.28	0.66
5	The FTL as a whole will be valuable and relevant to primary/secondary school mathematics curriculum.	Relevance to school mathematics curriculum	43	3.53	0.62
6	The FTL as a whole will be valuable and relevant to my teaching practice.	Relevance to teaching practice	43	3.28	0.79
	Total	**Overall Experience**	**43**	**20.37**	**2.31**

From table 5, the preservice mathematics teachers perceived that the overall experience in reading, preparing and interpreting FLT to be valuable to and relevant to their teaching practices (N=43, mean=20.28, SD=2.31). In particular, the preservice mathematics teachers were most likely to agree they understood use of basic mathematics knowledge and skills/operations and culturally responsive mathematics education, and could modify curriculum content and materials by incorporating culturally responsive mathematics content and pedagogy in their teaching practices.

Testing Hypotheses

Hypothesis One

HO_1: There is no significant difference in the mean performance scores of male and female preservice mathematics teachers in reading, preparing and interpreting football league table.

Table 6: t-test of mean scores of male and female preservice mathematics teachers (N= 43).

Gender	N	Mean	SD	DF	t-cal	P-value
Male	31	23.1	5.27	41	0.9978	0.324
Female	12	22.0	4.95			

Significant at P<0.05

From Table 6, t-cal (0.9978) is less than the table value of 2.02. With the p-value of 0.324 greater than the 0.05, the result indicates that there no significant difference between the mean performance scores of male and female preservice mathematics teachers. Therefore, the gender of preservice mathematics teachers does not influence their performance on the of basic mathematical knowledge and skills in reading, preparing and interpreting football league table.

Hypothesis Two

HO_2: There is no significant difference in the mean performance scores of preservice mathematics teachers who play football and those who do not.

Table 7: t-test of mean scores of preservice mathematics teachers who play football and those who do not play (N=43)

Play Football	N	Mean	SD	DF	t-cal	P-value
Yes	25	24.32	5.66	41	1.73	0.089
No	18	21.72	4.14			

Significant at P<0.05

From table 7, the t-cal of 1.73 is less than the table value of 2.02. With the p-value of 0.089 greater than 0.05, the results indicate that there is no significant difference between the mean performance scores of preservice mathematics teachers who play football and those who do not. Therefore, playing football does not influence the preservice mathematics teachers on the use of basic mathematical knowledge and skills in reading, preparing and interpreting football league tables.

Semi-Structured Interview: Data Analysis and Results

The qualitative data collected using semi-structured interviews was coded and interpreted thematically and then supported by qualitative data analysis in the form of texts and verbatim quotes from the respondents (Kamere, Makatiani & Nzau, 2018). The results are presented on eight themes in reading, preparing and interpreting football league tables, namely school mathematics concepts that can be taught to students, mathematical knowledge and skills that can be taught students, integrating preparation and interpretation of FLT into school mathematics curriculum, preparation and interpretation of FLT and interest of students, connecting Mathematics to football and attitude of students, preparation of FLT and school mathematics teaching methods/strategies, football cultural references as mathematics contexts, and relating mathematics to football and culturally responsive mathematics education. Thirteen (13) out of the 43 preservice mathematics teachers volunteered for the interview.

School Mathematics Concepts and Skills that can be taught to students

The findings revealed that most of the preservice mathematics teachers interviewed agreed that addition, subtraction, multiplication and division can be taught through reading, preparing and interpreting football league tables. In addition, one teacher wrote: "Mode, mean, range can also be used." Another teacher noted: "... other concepts that can be taught in school is(are) statistics, range, mean, median and etc." Yet, another teacher added: "... counting of numbers, mean, mode, range are mathematical knowledge and skills that can be taught students."

Most of the preservice mathematics teachers interviewed agreed that computational and Problem-solving skills can be taught in school mathematics using preparing football league table. On this one teacher declared: "We use statistical table for

inputting of values by counting using addition." Another teacher noted: "Arithmetic skills, problem solving skills, problem interpretation skills."

Integrating preparation and interpretation of FLT

Some of the preservice mathematics teachers agreed to the identification of the concepts and content in the curriculum where football league table materials and content can be applied in context of mathematics education. On this, one teacher said: "It can be integrated by relating it with a topic that suits it on the scheme of work - topics like the measure of central tendency." Thinking along the same line, another teacher noted: "Identify the concepts and contents, for example, you can use football league table to teach mean, mode and range." One teacher generally noted: "Identify the content, concepts where the league can be used in mathematics."

FLT and interest of students in learning mathematics

Most of the preservice teachers interviewed believe that with football being a popular sport with large youth followership who have great interest in the game, the students will be interested in the mathematics that will make them follow and understand the game. That is, the interest they have for football will be transferred to learning of school mathematics. Some commented as follows: One teacher said: "Because some students love football game, their interest towards learning mathematics will be very high." Another teacher noted: "Students have interest in games a lot. Introducing football league table which is game related will actually build interest on learning (mathematics) into the students." Another said: "Students love games and most students are interested in games ... since is something they love they have more interest in learning mathematics." One other teacher noted: "Since many young people love football, they will want to be attentive to a related topic." One further noted: "It can increase the students' interest since it is a game of fun that arouses their interest because of their love for football." Yet another teacher noted: "Football is interesting and presenting mathematics in a way that relates to football can really increase the interest of students." In conclusion, one teacher said: "Since football is considered an interesting sport, the league table which helps students gain more understanding and interest would also be interesting."

FLT and attitude of students towards learning Mathematics

Majority of the preservice mathematics teachers saw football as game that affect the interest and feelings of people which will affect their attitude towards learning mathematics. Students having positive attitude towards football will likely have positive attitude towards learning mathematics. On students' attitude, one preservice mathematics teacher wrote: "It can change their feelings towards mathematics, it can make them love mathematics instead of hating it." Another noted: "This will make students realise that mathematics is involved in all aspect of human activities, thereby making them to have a strong desire for mathematics learning." Another teacher said: "Connecting Mathematics to football will change their feelings, desires towards the subject (Mathematics) ... it will show that mathematics is no longer abstract or boring but can actually be fun." One other teacher noted: "Students love football and games (and) this can possibly change their feelings and attitude towards the subject ... (as) students see mathematics as a difficult subject." Furthermore, another teacher noted: "The introduction of the fun in football to mathematics teaching and learning can change the attitude of students towards mathematics (learning)." Conclusively, one teacher noted: "Since students are considered to have a positive attitude towards football, the league table would also create a positive attitude for the subject Mathematics."

FLT and teachers' teaching methods/ strategies

On connecting FLT and school mathematics to change teaching methods/strategies, most of the preservice mathematics teachers interviewed supported the use of student-centered methods by using real life situations and examples rather than abstract. Teacher 1, 2, 3, 4, 5 and 6 comments include:

Teacher 1: "Teaching Mathematics using football makes learning easier for the students. ... it makes learning mathematics a concrete experience ... And students are excited to be able to apply mathematical concepts in real life."

Teacher 2: "Using the environment to illustrate mathematics."

Teacher 3: "Citing necessary examples that can stimulate students' learning of mathematics just as football affects (changes) the abstractness of mathematics teaching methods."

Teacher 4: "It changes my teaching method because now I can use real life situations, something students are familiar with so it becomes easy to explain to the students."

Teacher 5: "The use of real life examples rather than abstract will be adopted into my teaching strategy."

Teacher 6: "It will help me to use real life situations to explain mathematical concepts and make the students and pupils discover other ways of solving mathematical problems."

Football cultural references and examples in Mathematics

Few of the preservice mathematics teachers interviewed could see cultural references in football and mathematics. Teachers 1, 2, 3 and 4 noted the following:

Teacher 1: "Mathematics will be seen as part of our culture and students' attitude towards Mathematics will change."

Teacher 2: "It will help the student to realise that mathematics can be applied to football thereby making it real. Students love or have interest in things that can be applied."

Teacher 3: "Generally people think mathematics is not relevant but it is; we us mathematics in almost everything including football, when playing football or calculating the league table."

Teacher 4: "Football has been a game of old, likewise mathematics. Continuous reference to the historical cultural relevance of Mathematics can help students see it as part of life."

Football and promotion of culturally responsive Mathematics education

Most teachers interviewed agreed to the teaching and learning of history of Mathematics as it is related to culture. Teachers 1, 2, 3, 4, 5, 6, 7 and 8 responses include:

Teacher 1: "History of mathematics should be taught to students culturally in ... relating mathematics to life events."

Teacher 2:

It will make the students to realise that mathematics is important and relevant to us and can be explained using real life situations and teachers will also use real life situations to teach mathematical concepts, and the perception of the community will change about mathematics.

Teacher 3: "We can make mathematics know in our culture by making our families and friends know the history of teaching and learning of Mathematics."

Teacher 4:

The history of Mathematics should be taught to the students and to the world. Knowing the origin of a thing will actually build a concrete understanding in the student, and also help the teacher develop methods to teach it. The history of Mathematics will prove to the students that it is life related.

Teacher 5:

History of mathematics should be taught to students culturally, orienting the students and members of the community that we use mathematics in our everyday life and in football. So, football to mathematics can promote a culturally responsive mathematical education.

Teacher 6: "Through teaching of mathematics from previous occurrences, previous knowledge and facts seen in our environment."

Teacher 7: "It (is) more constructive using the experience of the student to teach."

Teacher 8: "The teacher is able to ... incorporate a constructivism method in which mathematical concepts can be taught in the classroom by use of students' daily life experiences."

6. Discussion

The study examined preservice mathematics teachers' assessment of preparation and interpretation of football league table on school mathematics teaching and learning. Results show that high percentage of the 43 preservice mathematics teachers identifies five basic mathematical knowledge and skills for reading, preparing and interpreting football league tables. The five basic mathematical knowledge and skills are counting, addition, subtraction, multiplication and division which are used in calculating for total number of teams, total number of games, total goals scored, total points earned, total number of games won, total number of games lost, total number of goals against, total number of draws, goal difference and average goal scored. The semi- structured interview results confirm this five basic mathematical knowledge and in addition the use of statistical concepts such as mean, mode, median and range. Therefore, basic mathematical knowledge and skills are needed by teachers to read, prepare and interpret football league tables. These results confirmed Idehen and Oteze (2020) findings that Nigerian school teachers perceived that mathematical knowledge and skills such as counting, addition, subtraction, multiplication, division and ordering of numbers are needed by students to read, prepare and interpret football league tables. These findings could be in congruent with Reid and Reid (2017) study that assessed and identified numeracy skills in the areas of addition, subtraction, multiplication, division, fractions, percent, ratio, decimals, order of operations, and integers are the basic mathematics content needed to generate a comprehensive understanding of teacher candidates' mathematics content knowledge and their experiences as mathematics learners and teachers.

The study also assessed the level of performance of preservice mathematics teachers in the four mathematics areas of reading football league table (FLT), solving problems using FLT, making inferences from FLT and preparing FLT, and found

that the level is high with a grand mean performance score of 23.22. Therefore, the level of performance of preservice mathematics teachers is high in reading, preparing and interpreting football league table. Furthermore, results from the study show that the football league table is perceived by the preservice mathematics teachers to be relevant to school mathematics teaching practices in the constructs of understanding of basic mathematics operations, modification of Curriculum contents and materials using cultural activities, understanding of culturally responsive mathematics education, incorporation of culturally responsive mathematics content, and that FLT is valuable and relevant to school mathematics curriculum and teaching practices. To support this perception, those interviewed believed that connecting football cultural references and examples in Mathematics will help students to realise that mathematics contents are culturally based, and teachers can therefore change to relevant culturally responsive instructional approaches that would change the content and contexts of mathematics so as to improve academic outcomes. In connecting football league table and school mathematics to change teaching methods/strategies, most of the preservice mathematics teachers interviewed supported the use of student-centered methods through the application of real life situations and examples. Some recommended the inclusion of history of mathematics in school mathematics curriculum. History of mathematics should be taught to students culturally, orienting the students and members of the community that we use mathematics in football and in our everyday life. So the use of football to teach mathematics can promote a culturally responsive mathematics education. Therefore, teaching school mathematics will no longer be in abstraction but mathematics learning would be from concrete experiences as mathematics contents are illustrated from the familiar environment of the student. These findings are in agreement with those of Furuto (2016) where participants perceived that their professional development experience on using placed-based strategies, which recognized the importance of including students' cultural contexts in all aspect of learning, to be valuable and relevant to their teaching practices, such that would encourage them to modify curriculum materials to make them more relevant to their students through cultural activities and placed-based connections.

The study in addition assessed teachers' perception on how reading, preparing and interpreting the FLT will influence or affect students' interest and attitude towards learning mathematics. On FLT and interest of students in learning mathematics, most of the preservice teachers interviewed believe that with football being a popular sport with large youth followership who have great interest in the game, the students will be interested in the mathematics that will make them follow and understand the game. That is, the interest they have for football will be transferred to learning of school mathematics. On FLT and attitude of students towards learning mathematics, majority of the preservice mathematics teachers saw football as a game that affect the interest and feelings of people which will affect their attitude towards learning mathematics. Students having positive attitude towards football will likely have positive attitude towards learning mathematics. Therefore, students' interest and attitude will influence their learning of Mathematics.

On how some human factors could influence the performance of the preservice mathematics teachers, the study examined the variables of gender and playing football. Results from the study show that there is no significant difference between the mean performance scores of male and female preservice mathematics teachers; and that there is no significant difference between the mean performance scores of those who play football and those who do not. Therefore, the gender of or playing football by the preservice mathematics teachers does not influence their performance scores on the use of mathematical knowledge and skills in reading, preparing and interpreting football league tables. Thus, all teachers assessed and interviewed saw equally the relevance of reading, preparing and interpreting football league tables in teaching and learning school mathematics.

7. Conclusions and Recommendations

Based on the findings, the study concludes that counting, addition, subtraction, multiplication and division are basic mathematical knowledge and skills needed by preservice mathematics teachers in reading, preparing and interpreting football league table; and that computational and Problem-solving skills can be taught through the preparation of football league table. Furthermore, the study concludes that the football league table as perceived by the preservice mathematics teachers will be relevant and valuable to school mathematics teaching practices in the constructs of understanding of basic mathematics operations, modification of Curriculum contents and materials using cultural activities, understanding of culturally responsive mathematics education and incorporation of culturally responsive mathematics content. It is concluded that culturally responsive mathematics teaching methods/strategies should be promoted by use of student-centered

methods through the application of real life situations and examples. The conclusion is that the level of performance of preservice mathematics teachers is high in the four mathematics areas of reading football league table, solving problems using football league table, making inferences from football league table and preparing football league table. As teachers perceived that football is a popular game that affect the feelings and interest of students which will in turn affect their attitude towards learning mathematics, the study concludes that students' positive attitude towards football games will positively influence their dispositions towards learning school mathematics as basic mathematics knowledge and skills are needed in reading, preparing and interpreting football league table. On assessment of mathematics knowledge and skills, the study concludes that gender and playing football do not influence preservice mathematics teachers' performance on the use of mathematical knowledge and skills in reading, preparing and interpreting football league tables.

Based on the findings and conclusions, it is recommended that basic mathematical concepts, computational and problem-solving skills in school Mathematics curriculum be taught through culturally responsive mathematics contents and teaching methods/strategies by using real life situations and examples from the environment and community of the students. Preservice and inservice mathematics teachers should have professional development programmes, and attend seminars and workshops, that would encourage them to modify curriculum materials to make them more relevant to their students through cultural activities and culturally responsive mathematics education connections.

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Appendix A
Spanish La Liga Table :2019/2020 Season

Nos	Team	P	W	D	L	F	A	GD	Pts
	Real Madrid	38	26	9	3	70	25	+45	87
	Barcelona	38	25	7	6	86	38	+48	82
	Atletico Madrid	38	18	16	4	51	27	+24	70
	Sevilla	38	19	13	6	54	34	+20	70
	Villarreal	38	18	6	14	63	49	+14	60
	Real Sociedad	38	16	8	14	56	48	+8	56
	Granada	38	16	8	14	52	45	+7	56
	Getafe	38	14	12	12	43	37	+6	54
	Valencia	38	14	11	13	46	53	-7	53
	Osasuna	38	13	13	12	46	54	-8	52
	Athletic Bilbao	38	13	12	13	41	38	+3	51
	Levante	38	14	7	17	47	53	-6	49
	Real Valladolid	38	9	15	14	32	43	-11	42
	Eibar	38	11	9	18	39	56	-17	42
	Real Betis	38	10	11	17	48	60	-12	41
	Alaves	38	10	9	19	34	59	-25	39
	Celta de Vigo	38	7	16	15	37	49	-12	37
	Leganes	38	8	12	18	30	51	-21	36
	Real Mallorca	38	9	6	23	40	65	-25	33
	Espanyol	38	5	10	23	27	58	-31	25