

Could a mixed professional football league be viable?

Introduction	2
Title	2
Authors	2
Summary of the scenario	2
Age of the students	2
'Data Science Content in STEAM for Civic Engagement and Social Justice from the Early Years'	3
Subjects and topics	3
Real-life questions	3
Social and Equality Questions	3
Questions about evidence and trustworthy information	4
Questions about Human Performance	4
Questions about Economic and Finances	4
Media and public interest questions:	4
Questions about artificial intelligence	5
Questions about decision making and debate	5
Ethical questions	5
Metacognitive questions	5
Is the world interested in a competition of this kind? Objectives the scenario	5
Integrate disciplinary knowledge (mathematics, physical education, physics, language, and technology) into a meaningful and contextualised learning situation that allows students to take an informed and reflective stance on a current issue	6
Skills and competencies	6
Teaching approaches and learning strategies/theories	7
Relating the national curriculum with the DataScEd4CiEn scenario	8
Teaching resources (materials & technological tools)	18
Materials	18
Online tools	18
Evaluation	18
Initial assessment	18
Assessment tools	18
References:	18
Appendix:	20
Could a mixed professional football league be viable?	20
Justification of the learning situation	20
S1. Framing the problem: Reading 30': Where does mixed football fit in?	22
Before reading	22

While reading	22
After reading	24
S2. Research: What questions should we ask ourselves to determine whether a mixed league is viable?	25
S3 and S4. Analysis of the performance of male players from the four main teams in the Spanish	26
S5. Analysis of the performance of female football players	30
S6, S7. Artificial intelligence informs us about the viability of mixed leagues. We compare men and women	31
S8 and S9. Modelling the monetary value of a football player	33
What is a mathematical model?	33
S10. Is the world interested in a competition of this kind?	36
S12 and S13. Preparing for the debate:	37
S13 and S14. Debate	39
Portfolio Rubric	40
Rubric for the debate	43

Introduction

Title

Is a mixed professional football league viable?

Authors

Idea by José Antonio González Sayagues, student teacher, created by Ana Serradó Bayés.

Summary of the scenario

In this learning situation, students face the challenge of responding, from a critical and informed perspective, to the final question: "Is a mixed professional football league viable?" Throughout the process, students are guided on a journey in which they must evolve from their initial beliefs, possibly based on stereotypes or personal perceptions, towards an objective assessment based on the analysis of real and verified data.

To do this, they start by questioning where mixed football fits into the current sporting landscape and construct the problem through a series of key questions: What questions should we ask ourselves to assess the viability of a mixed league? What performance differences exist between men and women in professional football? What do the official data from men's and women's leagues at national and international level tell us? What is the economic value of footballers and what mathematical models are used to calculate their transfer fees?

Students conduct data science research, comparing the results obtained with the information provided by tools such as ChatGPT, which allows them to reflect on the reliability of different sources of information and possible biases in the interpretation of data.

The final product of this learning situation is a structured debate in which each team of students must take a position for or against the viability of a mixed professional football league, justifying their position with arguments based on the evidence gathered during the research.

Age of the students

14-15 years old. 3rd year of compulsory secondary education

‘Data Science Content in STEAM for Civic Engagement and Social Justice from the Early Years’

Subjects and topics

This learning situation is mainly developed in the subject of Mathematics, as the core of the STEAM approach, and is complemented by components of Science and Technology. In Mathematics, the aim is for students to mobilise and integrate their prior substantive knowledge (numerical models, proportions, descriptive and inferential statistics, functions, etc.) and contextual knowledge (sports economics, gender differences in performance, league structure) to analyse real data and construct informed answers to the final question about the viability of a mixed professional football league. This knowledge allows them to compare the results of their research with the information generated by ChatGPT, which enriches their analytical skills and encourages critical thinking and digital literacy.

From a scientific perspective, key variables related to athletic performance in professional football are introduced, such as speed, endurance, passing and shooting accuracy, training load, possession time, recovery, etc., allowing students to understand how these factors are quantified and objectively compared in men's and women's professional sports. This provides them with tools to make judgements based on evidence rather than stereotypes or assumptions.

The technology component is present in the use of various digital data analysis tools, such as Excel, Geogebra and CODAP, which allow students to organise, visually represent, interpret and model the data collected. These tools facilitate independent and collaborative work and promote the incorporation of digital competence as part of the research process

Real-life questions

The scenario has been organized as a core of questions to answer during the 13th sessions to integrate the different aspects of DataScEd4CiEn: Data Science, STEAM education, Civic Engagement and Equity as a Social Justice Issues. All the questions proposed should help become critical data literates and become healthy skepticism on data science.

Social and Equality Questions

These questions connect football with broader social debates about gender, equality, inclusion, fairness, and opportunities:

1. What is “mixed football”? What different interpretations or models could exist?
2. Do you think a mixed professional football league could be viable? Why or why not? What uncertainties do you see?
3. What arguments might someone disagreeing with you make?

4. What similarities and differences do you observe across different groups according to your graphs?
5. Are these groups directly comparable? Why or why not?
6. Could males and females videos have the same interest for the public?

Questions about evidence and trustworthy information

1. What kind of data would you need to evaluate its viability? How reliable might this data be?
2. The text states that mixed football is “well established in your categories”. What information would you need to verify this claim? How might the data be collected?
3. What potential biases might the media or clubs have in reporting on women joining men’s teams? How might this affect public perception of mixed football?
4. Are there gaps, missing variables, or uneven sample sizes that could distort conclusions?
5. Are both sets the ones of Transfermark and the ones generated by AI credible? Can you really compare them?
6. Where are the uncertainties in the AI generated? How do these uncertainties affect your results?
7. What kinds of opacity (missing provenance, representational gaps, or hidden biases) do you observe?

Questions about Human Performance

1. What factors are associated with good performance in men or/and women’s football?
2. What other contextual factors (e.g. investment, training conditions, competition structure) might affect the comparison?
3. What questions should you ask yourself in order to assess the differences between men and women in football?

Questions about Economic and Finances

1. What patterns of over- or under-valuation do you notice on the economic and financial variables, especially between men and female players?
2. Why might the AI be producing economic and financial gender inequalities even when the AI-dataset was generated for “fair” market values?

Media and public interest questions:

1. Think about how you should create a prompt to obtain from AI as many videos as you deem appropriate about football interest in mixed leagues?
2. Establish a strategy to answer the question preceding multiple cycles of inquiry: could males and females videos have the same interest for the public?

Questions about artificial intelligence

1. Are both sets of data the ones of Transfermark and the ones generated by AI credible? Can you really compare them?
2. Where are the uncertainties in the AI generated data?

Questions about decision making and debate

1. How can mathematics help to analyze the viability of a mixed league? What are its limits?
2. Do the questions posed and researched meet the requirements for being meaningful for answering the question: "Could a mixed professional football league be viable?"?

Ethical questions

1. What potential biases might the media or clubs have in reporting on women joining men's teams? How might this affect public perception of mixed football?
2. Could social, historical, or structural factors explain the patterns rather than the individual performance?
3. Why might the AI be producing gender inequalities even when the AI-dataset was generated for "fair" market values?
4. What kinds of opacity (missing provenance, representational gaps, or hidden biases) do you observe?

Metacognitive questions

1. How can mathematics help analyze the viability of a mixed league? What are its limits?
2. What does it mean to investigate data like a data scientist?
3. Why might your conclusions be limited?
4. What further data would strengthen your claims?
5. How confident are you in your conclusions, and what would you need to strengthen them?

Is the world interested in a competition of this kind? Objectives the scenario

- Critically analyse the viability of a mixed professional football league based on statistical data, official sources and research carried out during the project, while evaluating the reliability, completeness, origin, and possible limitations of the information used.
- Develop mathematical skills through the interpretation and representation of quantitative data (such as sports performance, player salaries, prediction models)

and costs), with a special focus on rigour, precision and the contextualised application of knowledge, and critical evaluation of the validity and uncertainty of datasets.

- Encourage critical thinking by comparing one's own conclusions with sources generated by artificial intelligence (such as ChatGPT), identifying biases, assumptions, missing information, inconsistencies, coincidences or discrepancies between the information analysed by the students and that generated automatically by AI.
- Develop healthy skepticism toward AI-generated information by questioning how data and conclusions are produced, recognising that AI systems may generalise, reproduce social biases, omit relevant context, or generate unreliable or unverifiable information.
- Promote data literacy through the critical examination of datasets, including the identification of sampling issues, representational gaps, hidden biases, missing variables, opacity in data generation processes, and limitations when comparing different data sources.
- Promote logical and reasoned argumentation in a debate context, using appropriate technical language, coherent discursive structures, and evidence based on critically interpreted data to defend a position for or against the mixed league, while acknowledging uncertainty and alternative interpretations.
- Encourage effective oral expression and teamwork through active, respectful and collaborative participation in the debate, including skills such as active listening, respect for turns, the development of relevant replies and counter-replies, and time management.
- Develop creativity in the presentation of conclusions, graphs, models, and value propositions related to professional mixed football, encouraging the generation of original ideas and innovative solutions, and critical reflection on the ethical and social implications of data-driven and AI-supported decision-making.

Integrate disciplinary knowledge (mathematics, physical education, physics, language, and technology) into a meaningful and contextualised learning situation that allows students to take an informed and reflective stance on a current issue

Skills and competencies

According to the theoretical framework proposed by Lee et al. (2022), students bring the following key dispositions into play.

1. Curiosity and willingness to explore:

Students are open to asking their own questions about the data, looking for patterns, trends or anomalies, and adopting an investigative stance. In this learning situation, this disposition is activated when students ask themselves:

- What differences in performance exist between men and women?
- What data could predict the success of a mixed league?
- What patterns emerge when comparing international leagues?

2. Willingness to be critical of data:

Students do not accept data as absolute truths, but question it: Where does it come from? Is it reliable? Does it represent what it claims to represent? In this scenario, this critical disposition comes into play when they compare:

- Statistical results versus media narratives.
- ChatGPT responses versus analysed data.
- Official sources (FIFA, national leagues) versus constructed or selected data.

3. Willingness to construct conjectures and explanations based on data:

Students generate hypotheses and argue possible explanations based on quantitative evidence. In the context of mixed football, students:

- Interpret performance or cost graphs.
- Propose explanations for inequalities in player fees or minutes played. • Propose mathematical models to assess economic viability.

4. Willingness to review and refine ideas:

During the analysis process, students adjust their interpretations or change their minds as new data or counterarguments emerge. In this scenario:

- They evolve from preconceived ideas to more informed positions.
- They incorporate feedback from teachers, peers, or data.
- They reformulate their arguments in the debate based on new evidence.

5. Willingness to communicate and share in a meaningful way

Students show a willingness to present their findings clearly, effectively, and persuasively, adapting to different audiences or formats. This is evident in:

- The structuring of the debate discourse.
- The use of graphic visualisations to communicate complex ideas.
- The preparation of responses that respond respectfully and reasoned to their opponents.

Teaching approaches and learning strategies/theories

Although this learning situation is implemented exclusively in mathematics, it is clearly based on the principles of a STEAM (Science, Technology, Engineering, Arts & Mathematics) approach, as it promotes a meaningful integration of knowledge, skills and ways of thinking associated with various disciplines, with an authentic and socially relevant purpose. From the STEAM framework, analysing the feasibility of a mixed football league not only activates mathematical knowledge (data processing, proportionality, functions, statistical analysis, etc.), but also:

- Articulates science and physical education content: physiological differences, athletic performance, gender and sport.
- It integrates technology through the use of digital tools (generative AI such as ChatGPT, spreadsheets, data visualisation, etc.).

- It incorporates critical thinking and creativity as pillars (typical of the artistic and humanistic approach in STEAM) through debate, persuasive communication and the exploration of non-obvious solutions.

This learning situation follows an active methodology based on inquiry-based learning, real data analysis and critical thinking. It is organised into several coherent phases, which develop not only mathematical content, but also the key competences of the STEAM approach:

1. Activation of prior ideas and formulation of the problem. Students reflect on their initial beliefs about mixed football. The initial question that guides the scenario is introduced: "Is a professional mixed football league viable?", activating curiosity and a willingness to explore.
2. Asking questions and organising the analysis. Research sub-questions are structured (presented in the [Skills and competencies](#) section).
3. Data search and analysis Comparison with AI-generated sources (ChatGPT).
4. Drawing conclusions
5. Debate as the final product.
6. Self-assessment and final reflection.

In other words, this learning situation promotes data science education focused on the development of critical, interpretative and communicative skills that transcend the simple technical use of statistical tools. Students are encouraged to develop the ability to read the world through data, identify patterns, recognise biases and compare sources with intellectual autonomy. It also highlights the role of mathematics not as a closed or abstract discipline, but as a language for modelling real phenomena, formulating evidence-based arguments and participating in informed public discussions.

Through the exploration of a contemporary social problem, students experience data science as a means to make informed decisions and actively contribute to a critical, reflective citizenry committed to equity and social justice. In this approach, communicating findings is not a final step, but part of the process of knowledge construction, where argumentation, visualisation, and ethical responsibility in the use of data are essential.

Relating the national curriculum with the DataScEd4CiEn scenario

The following table shows the correspondence between the key competences defined in the LOMLOE for the Compulsory Secondary Education stage and the descriptors that are specifically worked on in the learning situation "Is a mixed professional football league viable?". This table serves as a support for the teaching programme and as a pedagogical justification for the proposal.

Key Competence	Descriptors Worked on in the Learning Situation
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Mathematical competence and competence in science, technology and engineering (CMCT)	CMCT1. Poses and solves problems using mathematical tools in real-life contexts. CMCT2. Interprets data and graphs to understand complex situations and make informed decisions. CMCT4. Applies mathematical models to explain observable phenomena and argue conclusions.
Digital competence (DC)	CD2. Evaluates the reliability, quality and bias of digital information. CD3. Uses digital technologies to process, represent, and share information. CD5. Use digital environments for collaboration and effective communication of ideas.
Personal, social and learning to learn competence (PSL)	PSLLA1. Strives to improve their learning and recognises their mistakes as part of the process. CPSAA3. Cooperates in a team and contributes to shared learning. PSLLC4. Reflects on their ideas, argues with evidence and is open to revising their opinions.
Citizenship competence (CC)	CC2. Participates actively and articulately in social debates from a critical perspective. CC3. Recognises the importance of equal rights between women and men in different areas. CC4. Analyses and evaluates different positions with empathy, respect and critical reasoning.
Linguistic communication competence (LCC)	LCC2. Communicate complex ideas effectively using appropriate language. CCL3. Argue your points of view coherently, using examples and evidence. CCL5. Participates actively in communicative exchanges, taking turns, listening and responding.
Entrepreneurial competence (CE)	CE1. Identifies opportunities for improvement or solutions in social or personal contexts. EC2. Shows initiative in proposing ideas and strategies for open-ended problems. CE4. Accepts uncertainty and mistakes as part of the creative and decision-making process.

Cultural awareness and expression (CCEC)	CCEC1. Uses visual, verbal, or body language to express ideas and emotions. CCEC3. Critically analyses cultural elements present in their environment (such as sport and its stereotypes). CCEC4. Integrates creative elements into the development of their personal productions.
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Educational Scenario Planning

Description of the lesson plan: name of the activity, subject, procedures, time, resources. Complete the next table and include the links to the Annexes section with the detailed description of the activity.

Name of the activity	Procedures	Time/Annex
Lesson 1: S1. Framing the problem. Where does mixed football fit in?		
STEAM subject	- Expressing individual and team opinions on what mixed football is, on the idea of introducing a mixed category in football, how it could be financed, how mathematics can help to create a mixed football league. - Reading the article: Male, female and... mixed. - After reading, analyse what mathematics is needed to study the feasibility of a mixed football league from a social and ethical point of view. - Analysis of what statistical research is, what phases statistical research has, what the population and sample are, what a variable is, and the values and types of variables. - Analysis of the problem, "Is a mixed professional football league viable?", the study population, the sample of players, the variables, values and types of variables we need to work with to answer the question.	Appes1. Framing the problem: Reading 30': Where does mixed football fit in? 60

Expected learning outcomes	Critically analyse the viability of a mixed professional football league based on statistical data, official sources and research carried out during the project.
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Lesson 2: S2. Research: What questions do we ask ourselves to find out if the mixed league is viable?		
STEAM subject	1. Analysis of the conditions that a question must meet in order to be statistically significant. 2. Work as a team to come up with three questions that will help answer different aspects of the validity of a mixed football league.	S2. Research: What questions should we ask ourselves to determine whether a mixed league is viable? 60
	3. Check whether the questions meet the requirements established above.	
Expected learning outcomes	Promote logical and reasoned argumentation in a debate context, using appropriate technical language, coherent discourse structures and data-based evidence to defend a position for or against the mixed league. Integrate disciplinary knowledge (mathematics, physical education, physics, language and technology) into a meaningful and contextualised learning situation that allows students to take an informed and reflective stance on a current issue.	

Lesson 3: S3 and S4. Analysis of the performance of male players from the four main teams in the Spanish league.
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STEAM subject	1. Access to the spreadsheet of men's football statistics and analysis of the number of cases in the table, the name of two qualitative statistical variables, two discrete quantitative statistical variables and two continuous quantitative variables. 2. Consider and answer the question: what factors are associated with good performance in men's football? 3. Analysis of these factors using the CODAP programme. 4. Construct a graph that answers the question: "What is the number of goals scored by each player?" 5. Construct a graph that answers the question: "How are the goals scored by forwards and centre forwards distributed?" 6. Construct a graph for the age of the players. 7. Construct and interpret a graph that relates the age of the player to the number of seconds of ball possession. 8. Construct and interpret a graph showing the relationship between seconds of ball possession and goals and assists scored. 9. Write a newspaper article describing the factors associated with good performance in football based on the graphs and interpretations obtained in the previous activities.	S3 and S4. Analysis of the performance of male players from the four main teams in the Spanish 120
Expected learning outcomes	Develop mathematical skills through the interpretation and representation of quantitative data (such as sports performance, player profiles, prediction models and costs), with a special focus on rigour, precision and the contextualised application of knowledge.	
	Integrate disciplinary knowledge (mathematics, physical education, physics, language and technology) into a meaningful and contextualised learning situation that allows students to take an informed and reflective stance on a current issue.	

STEAM subject	1. Analyse the spreadsheet in the appendix and think about what questions should be asked to determine the performance of women in football. 2. Access the CODAP platform to carry out the analysis you have planned to answer the questions. 3. Analyze the results on females's football performance by comparing across the multiple dimensions you have researched. Then, critically evaluate the differences: across different groups, contextual factors, representativeness in the dataset, gaps, missing variables, or uneven samples sizes, assumptions made, influences of external factors, alternative observed patterns, confidence on the conclusions 4. Discuss what differences you have found compared to the results on men's performance in football.	S5. Analysis of the performance of female football players 60
Expected learning outcomes	Develop mathematical skills through the interpretation and representation of quantitative data (such as sports performance, player profiles, prediction models and cost), with a focus on rigour, precision and the contextualised application of knowledge, and critical evaluation of the validity and uncertainty of datasets.	

Lesson 5: S6 and S7. ChatGPT informs us of the viability of mixed leagues. We compare men and women.

STEAM subject	1. Access ChatGPT and write a prompt so that: a. the artificial intelligence explains the viability of mixed football leagues. b. artificial intelligence leans towards the impossibility of a mixed football league existing. 2. Write the answers and compare the answers of the team to critically analyze the differences, causes, and reliability of the conclusions. 3. Analyse which variables (magnitudes) and units of measurement are related in the spreadsheet created with ChatGPT about a mixed league with 100 female and male players. 4. Based on the information obtained from activities 1 and 2, consider what questions should be asked in order to assess the differences between men and women in football. 5. For each of the questions posed, construct a	S6, S7. Artificial intelligence informs us about the viability of mixed leagues. We compare men and women 120
	graph where the horizontal attribute is gender, compare the results and interpret them. 6. Perform an analysis using a box and whisker plot to compare gender in the following attributes: age, maximum speed, passing accuracy, goals per season. 7. Reread the information obtained from ChatGPT and indicate what data is missing or incomplete, different ideas or guessed, comparing the credibility of the Transfermark and AI-generated data sets, 8. Conclude on the validity of the data obtained from ChatGPT based on the analysis of age and goals scored in sessions S3, S4, and S5 for male and female footballers.	

Expected learning outcomes	Encourage critical thinking by comparing students' own conclusions with information and datasets generated by artificial intelligence tools (such as ChatGPT), identifying biases, assumptions, missing information, inconsistencies, coincidences, or discrepancies between human research, official data, and automatically generated outputs. Critically analyse the viability of a mixed professional football league based on statistical data, official sources, and research carried out during the project, while evaluating the reliability, completeness, origin, and possible limitations of the information used. Develop healthy skepticism toward AI-generated information by questioning how data and conclusions are produced, recognising that AI systems may generalise, reproduce social biases, omit relevant context, or generate unreliable or unverifiable information.
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Lesson 6: S8 and S9. Modelling the value of a football player		
STEAM subject	1. Analyse what a mathematical model is. 2. Evaluate the processes for determining the mathematical model to determine the market value of a player. 3. Analyse the example of Neymar's market value. 4. Automate the processes in Google Calc to calculate the market value of the data obtained in the previous session of the prompt carried out in ChatGPT.	S8 and S9. Modelling the monetary value of a football player 120'
Expected learning outcomes	Critically analyse the viability of a mixed professional football league based on statistical data, official sources, and research carried out during the project, while evaluating the reliability, completeness, origin, and possible limitations of the information used. Develop mathematical skills through the interpretation and representation of quantitative data (such as sports performance, player salaries, prediction models, and costs), with a special focus on rigour, precision, contextualised application of knowledge, and critical evaluation of the validity and uncertainty of datasets.	

Lesson 7: S10. Is the world interested in a competition of this kind?

STEAM subject	Unlike the other activities, which are carried out in groups with the aim of promoting dialogue between the team of students or the class group, in this case the activity is carried out individually in order to establish whether the students are able to apply the data science strategies learned in previous sessions. 1. Think about how to create a prompt to obtain videos from ChatGPT to analyse the world's interest in the competition. 2. Establish a strategy to answer the question: what are the differences between women's and men's football videos? 3. Answer the question with the help of the CODAP or Geogebra programme. 4. Interpret the results and draw conclusions about the corresponding question.	S10. Is the world interested in a competition of this kind?
Expected learning outcomes	Develop healthy skepticism toward AI-generated information by questioning how data and conclusions are produced, recognising that AI systems may generalise, reproduce social biases, omit relevant context, or generate unreliable or unverifiable information. Promote data literacy through the critical examination of datasets, including the identification of sampling issues, representational gaps, hidden biases, missing variables, opacity in data generation processes, and limitations when comparing different data sources.	

Lesson 8: S11 and S12. Preparing for the debate		
STEAM subject	1. Read the rubric for improving the portfolio with all the suggestions received from the teacher during previous sessions. Set a schedule for submitting this review. 2. Read the rules for the debate to be held. 3. Read and analyse the debate rubric. 4. Based on your notes, prepare the organisation of the debate, the information you will provide, what you will reply or counter-reply, and what questions you will ask the other team.	S12 and S13. Preparing for the debate: 120

Expected learning outcomes	Promote logical and reasoned argumentation in a debate context, using appropriate technical language, coherent discursive structures, and evidence based on critically interpreted data to defend a position for or against the mixed league, while acknowledging uncertainty and alternative interpretations. Encourage effective oral expression and teamwork through active, respectful, and collaborative participation in the debate, including skills such as active listening, respect for turns, the development of relevant replies and counter-replies, constructive questioning of evidence and assumptions, and time management. Develop creativity in the presentation of conclusions, graphs, models, and value propositions related to professional mixed football, encouraging the generation of original ideas, innovative solutions, and critical reflection on the ethical and social implications of data-driven and AI-supported decision-making.
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Lesson 9: S13. Debate and self-assessment of learning		
STEAM subject	1. Team debate. Decision on who is for or against. 2. Conduct the debate according to the rules. 3. Self-assess learning according to the PostStudents survey form found in the WP6 documents for students.	120 minutes (depending on the number of teams competing)
Expected learning outcomes	Promote effective oral expression and teamwork through active, respectful and collaborative participation in the debate, including skills such as active listening, respect for turns, the development of relevant replies and counter-replies, and time management.	

Describe for each category the time planned for its implementation

Teaching time planned for each of the STEAM subjects

780 minutes spread over 13 work sessions.

Assessment time: There is no specific assessment time, as it is integrated into the implementation process of the different sessions.

Teaching resources (materials & technological tools)

Describe the teaching materials and technological tools to be used in the different lessons

Materials

The materials to be used are included in the various appendices to the work.

Online tools

Geogebra: [geogebra.org](https://www.geogebra.org)

CODAP: <https://codap.concord.org/>

ChatGPT

Evaluation

Initial assessment

There is no initial assessment, but rather an assessment session in which students present their beliefs about the viability of a mixed professional football league.

Assessment tools

Describe the tools used for the assessment of:

- the students' data science knowledge in civic engagement and social justice in the topic of the scenario that you have planned:
 - Activities for sessions 1 to 9
 - The individual activity in session 10
 - Improvement of activities based on the final portfolio.
 - Participation in the debate according to the corresponding rubric.
- Students' disposition to learning data science. (Annexes used in the classroom are welcome)
 - The DataScEd4CiEn students' post-survey.

References:

Henriksen, D., DeSchryver, M., & Mishra, P. (2020). Rethinking technology & creativity in the 21st century: Crayons are the future. *Journal of STEM Education*, 21(1), 23–30.

Lee, H. S., Wilkerson, M., Grover, S., Shin, H., & Macrander, C. (2022). *Developing students' data science competencies through exploratory data analysis tasks: A framework and design principles*. *Journal of the Learning Sciences*, 31(1), 60–101.

Serradó, A., & Meletiou-Mavrotheris, M. (in press). Fostering Critical Data Literacy and Healthy Skepticism Toward Generative AI Through a Gender Equity in Football Scenario. *Quaderni di Ricerca in Didattica*,

Appendix: Could a mixed professional football league be viable?



¡Así fue una jornada muy especial en el Centro Deportivo Wanda Alcalá de Henares! Atlético de Madrid (2020). <https://youtu.be/UihJF4syOtU?si=6iQmWT1arNQfiNDg>

Justification of the learning situation

The main objective of this learning situation is to show you how mathematics exists in a real-life context that, at first glance, seems to have little to do with mathematics, such as football. In addition, thanks to the mathematical study we will carry out, we will be able to answer important current issues such as promoting gender equality.

The assessment of this learning situation will be carried out by means of:

- Work portfolio, which includes:
 - Research activities on the feasibility of creating a mixed professional league
 - Self-assessment
 - Co-evaluation

- Final product: Mathematically based debate on whether the creation of a professional mixed league is feasible.

S1. Framing the problem: Reading 30': Where does mixed football fit in?

Before reading

- What is “mixed football”? What different interpretations or models could exist?
- Do you think a mixed professional football league could be viable? Why or why not? What uncertainties do you see?
- What kind of data would you need to evaluate its viability? How reliable might this data be?
- If the league were created, how could it be financed?
- How can mathematics help analyze the viability of a mixed league? What are its limits?
- What arguments might someone disagreeing with you make?

While reading

Male, female and... mixed. One of the great strengths of football is its diversity. It does not matter the race, origin, age or even gender of those who play it, although this can sometimes be a problem beyond the pitch, in the boardrooms. Football is football in each and every one of its varieties or genres. On this last issue or identity, there is a tendency to identify **two types of football: women's and men's** (popularly, it is not usually called men's because of its historical significance, even though it is). But **where does mixed football fit in?** Is it possible to introduce this category into the football industry? Is it viable or effective to commit to it? The debate is complex...

It is important to note that this mixed category, where the distinction is not based on gender but on level, **does not appear on the social agenda as a claim.** With women's football still fighting to make its way in this sport, where the barriers have been

endless for years, there is little effort left to research or experiment in the field to see if a mixed category is possible within a professional framework. This discipline is well established in youth categories and **there are even some specific examples, mainly of women, who have continued in a club of a different gender** beyond the usual ages in grassroots football clubs. However, these cases remain mere anecdotes on the pitches and in the media that report on them and **do not reflect the essence or nature of mixed football.**

We are talking about specific situations, in which the prototype is usually a woman who becomes part of a team of men. But is this legal? Can a female footballer play football with men? The answer is provided by **Reyes Bellver, a lawyer specialising in sports law** and partner at Bellver Sports legal boutique. "If the requirements to compete are met and there is no provision prohibiting it, there may be examples, as in this case, but I do not see them as mixed football. **The exceptions are based on the principle of equality that competitions and teams must have, but they do not represent mixed football,**" she points out in an interview with AS.

Bellver delves into the legality that protects the right of a woman to join a men's team outside of youth categories. **"There is no general provision that expressly prohibits a woman from joining a men's team** if the club and territorial regulations allow it. For me, that's ideal. Don't prohibit access, but then separate women's and men's football," says Reyes, who points out that **mixed football is generally played, with some exceptions, up to the age of 14 or 15.**

"From that age onwards, they are segregated and it is true that women have fewer opportunities than men, although that is also changing with the emergence of more and more women's teams," she adds, after explaining that football regulations in general do not specify anything about the men's category in this sport. It has always been "football" and "footballers" without distinction of gender. With the rise of

women's football, additional provisions were introduced to these regulations that do refer to gender, although only to the female gender.

For this reason, it may even be more difficult for a man to join a women's team than vice versa. This is because the regulations in the latter category refer to players and emphasise the presence of the female gender in their rules. Of course, everything will always depend on the statutes of each territory and club.

After reading

1. The text states that mixed football is “well established in youth categories”. What information would you need to verify this claim? How might the data be collected?
2. The text discusses the barriers women face in football. How could we critically assess whether these barriers are still “endless” today? What kind of data practices would help?
3. What potential biases might the media or clubs have in reporting on women joining men's teams? How might this affect public perception of mixed football?
4. If you were tasked with designing a study to analyze whether mixed football is viable at a professional level, what variables would you measure.
5. Explain.
 - a. What does it mean to investigate data like a data scientist?
 - b. Which phases does it have?
2. Watch the next video  **Introduction to Populations and Samples** and answer the next questions in the context of the problem “Could a mixed professional league be viable?”
 - a. What is the population of study?
 - b. What sample of players do you think that we should choose to ensure the viability of the mixed professional league?
 - c. Could the sample you select be biased?
 - d. What variables should we consider to work with this question?

S2. Research: What questions should we ask ourselves to determine whether a mixed league is viable?

One of the main arguments for making a decision of this magnitude is to find out whether people would be interested in a league of this type. Our goal is to create a set of questions that will allow us to gather the opinions of members of the educational community about mixed football leagues.

For a question to be meaningful, it must meet a series of requirements, which we list in the following table:

Look at the question	Question variables	Relationship between the question and the data
Is the question meaningful?	Are the variables clearly described?	Is it a research question?
Will it maintain interest?	Are the variables in the question feasible and measurable?	Does it require a numerical answer?
Is the intention of the question clear or ambiguous?		Does the question require a grouped response?
What variables are embedded within the question?		Does the question require the identification of a specific value? (mean, mode, ratio, percentage, etc.)
Is the population of interest clear?		Does the question require exploring a comparison between two groups, the relationship between two variables, or a more in-depth exploration of the data?

1. As a team, think of three questions that will allow you to answer different aspects of the validity of a mixed football league.
2. Check that the questions meet the requirements for them to be meaningful for answering the question: "Could a mixed professional football league be viable?"

S3 and S4. Analysis of the performance of male players from the four main teams in the Spanish

1. Access the following spreadsheet:  Men's football data and answer the following questions:
 - a. How many cases (players) are there in the spreadsheet?
 - b. Indicate the names of two qualitative statistical variables?
 - c. Indicate the names of two discrete quantitative statistical variables?
 - d. Indicate the name of two continuous quantitative variables?
2. Think about and answer the question: what factors are associated with good performance in men's football?

The previous table has been copied to the CODAP statistical data analysis programme, which you will find at the following link.

Click on it:

<https://codap.concord.org/beta#shared=https%3A%2F%2Fcfm-shared.concord.org%2F9jtc41zrwApcYXfbYCof%2Ffile.json>

3. Create a graph that answers the question: "How many goals did each player score?" To do this:
 - a. Click on graphs and a screen like this will open



- b. Click on the horizontal bar and select the variable goals (Gls.).



- c. Click on the group into bins.



graph tool and select

- d. Click on the ruler and select count and percentage.
e. Cut out the graph and paste it here

In the graph above, we have observed that the highest percentage corresponds to players who score zero goals. As we know, this depends on the position on the field. Therefore, we are going to improve the analysis by filtering the positions of forward and centre forward.

4. Create a graph that answers the question "How are the goals scored by forwards and centre forwards distributed?" To do this:
- a. Click on graphs and a screen like this will open



- b. Click on the horizontal bar and select the variable goals (Gls.).
- c. Click on the vertical bar and select the variable position (Pos).
- d. Filter the results for forwards and centre forwards by drawing a rectangle from right to left and top to bottom that selects players in the forward and centre forward positions.



- e. Click on the unselected



eye and "Hide cases".

- f. Click on the group into



graph tool and select bins.

- g. Click on the ruler and select count and percentage.
 - h. Take a screenshot of the graph and paste it here.
5. Construct a graph of the players' ages and use the tools:
- a. graph tools to group into bins
 - b. the ruler to count, display labels, determine measures of central tendency (mean and median), and measures of dispersion.
 - c. Cut out the graph and paste it here.
6. Construct and interpret a graph that relates the player's age to the number of seconds of ball possession.

7. Construct a graph and interpret the relationship between seconds of ball possession (90s) and goals and assists (G+A). Paste the graph here.
8. Think about this questions related to the graphs that you have constructed:
 - a. What trends or patterns do the graphs show?
 - b. Which variables seem important for performance?
 - c. Do any graphs or data points seem contradictory?
 - d. How can you explain the differences?
 - e. How will you present your ideas for writing a news article (up to 250 words) for Golsmedia, Marca or Diario AS?
 - f. Why might your conclusions be limited?
 - g. What further data would strengthen your claims?
9. Write a news article (up 250 words) for Golsmedia, Marca, or Diario AS about the factors associated with good male performance in football. This should include:
 - a. Description of key patterns and variables from the graphs
 - b. Discussion of contradictions, anomalies, or unexpected trends
 - c. Reflection on limitations and uncertainties
 - d. Suggestions for what further data would improve understanding.

S5. Analysis of the performance of female football players

1. Analyse the following spreadsheet and think about what questions you would ask to find out how women perform in football:  Female's football data
2. Access the CODAP platform to carry out the analysis you have planned.
<https://codap.concord.org/beta#shared=https%3A%2F%2Fcfm-shared.concord.org%2FXXAYHFvtxm10GCwd9TH9%2Ffile.json>
3. Analyze your results on female's football performance by comparing across the multiple dimensions you have researched. Then critically evaluate the differences by addressing the following questions:
 - a What similarities and differences do you observe across different groups according to your graphs?
 - b Are these groups directly comparable? Why or why not?
 - c What other contextual factors (e.g. investment, training conditions, competition structure) might affect the comparison?
 - d Are all groups equally represented in the dataset?
 - e Are there gaps, missing variables, or uneven sample sizes that could distort conclusions?
 - f What assumptions are you making when interpreting these differences?
 - g Could social, historical, or structural factors explain the patterns rather than individual performance?
 - h Do the data show relationships or can you infer causes?
 - i What alternative explanations could account for the observed patterns?
 - j How confident are you in your conclusions, and what would you need to strengthen them?

S6, S7. Artificial intelligence informs us about the viability of mixed leagues. We compare men and women

1. Individually, access an Artificial intelligence and write two prompts:
 - a. Prompt 1: Ask AI to explain the viability of mixed professional football leagues, noting data limitations and gaps.
 - b. Prompt 2: Ask AI to argue that a mixed football league is likely impossible, highlighting assumptions and biases in its reasoning.
2. Write the answers of each prompt here.
3. Compare the answers of your team and critically answer:
 - a. What differences do you see in your team's answers?
 - b. Why are they different?
 - c. Do these differences make your conclusions more or less reliable?

ChatGPT has helped us create the following database on a mixed league with 100 female and male players Access it here:

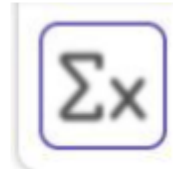
<https://codap.concord.org/app/static/dq/es/cert/index.html#shared=https%3A%2F%2Fcfmshare.concord.org%2F51ZgldU7yVWbleYZVqtO%2Ffile.json>

4. Analyse which variables (magnitudes) and units of measurement it relates to.
5. Based on the information obtained from activities 1 and 2, consider what questions you should ask yourself in order to assess the differences between men and women in football.
6. For each of the questions you have asked yourself,
 - a. create a graph (with gender on the horizontal axis and the attribute to be analysed on the vertical axis),
 - b. paste it here,
 - c. compare the results for females and males, and interpret the results.
7. Access the following Geogebra Classic:
<https://www.geogebra.org/classic/skjwhjep>
 - a. For the age attribute:

- i. Select the male and female age columns simultaneously.
- ii. Create a multivariate analysis diagram for the age



variable.



- iii. Display the parameters
- iv. Export the image.
- v. Paste here the graph and statistics that you have obtained.

- b. Perform the same processes for the attributes of:
 - i. maximum speed
 - ii. pass accuracy
 - iii. goals per season
- c. Which might you see in the graphs? What could be true, and what is not sure?
8. Look again at the information that AI gave you in task number 1. Compare it with the data you have collected in activity number 7.
 - a. What is the same in both sets of data? What is different?
 - b. Why do you think there are differences? Could it be because:
 - i. Some data is missing or not complete?
 - ii. Different ideas or guesses were used?
 - iii. The AI made mistakes or generalized too much?
 - c. Are both sets of data the ones of Transfermark and the ones generated by AI credible? Can you really compare them?
 - d. Where are the uncertainties in the AI generated? How do these uncertainties affect your results?
 - e. How sure are you about your conclusions? What extra data would help you be more sure?

S8 and S9. Modelling the monetary value of a football player

What is a mathematical model?

A mathematical model is a set of mathematical operations and symbols (relationships) that attempts to explain a real-life phenomenon, situation, system or process.

We are interested in creating a mathematical model to find out how much money a football player is worth.

Throughout this activity, we will study how the price of players is calculated in the market, since an essential factor in creating a league is knowing the price of the players.

We are going to study this using a mathematical model, which explains a player's value based on a series of variables.

The model is as follows needs to compute:

- The youth coefficient
- The position coefficient
- The footballing quality
- The media value
- The market value

The computation of each of them needs of some formulas or ratios, which are:

Youth coefficient.

$$CJ = \left| 1 - \frac{(Age-23)}{10} \right|$$

Position coefficient

CP is:

- *1 if he/she is front*

- 0,75 if he/she is *midfielder*
- 0,5 if he/she is *lateral, defense or golier*

Footballing quality

$$CF = \frac{(TT \text{ Level of the player}) \cdot CP}{10}$$

Media value

$$VM = \frac{(TT \text{ Level of the player}) + PHYS + SPEC + DEP + SS + PP}{10}$$

Market value

$$MERC = (CJ \cdot CF + VM) \cdot 50 \text{ million of euros}$$

Our goal is to programme these calculations into the database we have built with the help of ChatGPT in order to assess whether female and male footballers can have the same market value.

1. Program the market value coefficient for the To do all the players:
 - a. Access to the "*market value sheet*" that you will find in SalleNet
 - b. In column L, create the *youth coefficient* by programming the corresponding formula
 - c. In column M, create the *position coefficient* by filtering the column.
 - d. In column N, create the quality coefficient
 - e. In column O, create the media value coefficient
 - f. In column P, create the market value coefficient
2. In Geogebra classic <https://www.geogebra.org/classic?lang=es>
 - a. A spreadsheet with the market values of men in one column and the market values of women in another.
 - b. Perform a multidimensional analysis of market values (MERC)
 - c. Visualise the parameters.
 - d. Which might you see in the graphs? What could be true, and what is not sure?

3. Check the data against reality:

Compare the values of the AI-generated dataset with the most recent verified market values from Transfermarkt

(https://www.transfermarkt.es/spieler-statistik/wertvollstespieler/marktwertetop/plus/0/galerie/0?ausrichtung=Sturm&spielerposition_id=alle&altersklasse=alle&jahrgang=0&land_id=0&kontinent_id=0&yt0=Anzeigen)

- a. Which value is consistent? Which value is clearly off?
- b. What patterns of over- or under-valuation do you notice, especially between male and female players?

4. Interrogate the AI-generated dataset:

- a. What kinds of opacity (missing provenance, representational gaps, or hidden biases) do you observe?
- b. Why might the AI be producing gender inequalities even when the AI-dataset was generated for “fair” market values?

S10. Is the world interested in a competition of this kind?

Individual activity

Probably the most important factor when making a decision of this magnitude is knowing whether or not the world is interested in it. To find this out, we will go to <https://www.youtube.com/> and search for videos of male and female football, on any topic: matches, transfers, controversies, etc.

One way to proceed would be to search YouTube for men's football and obtain a series of videos, for which we will record the views in a spreadsheet. We will do the same for women's football.

However, there is another way to proceed, which is to use an AI tool. To do this,

1. Think about how you should create a prompt to obtain as many videos as you deem appropriate about football, with the title and corresponding link, classified according to gender (male or female), the purpose of the video, its duration, its target audience (adults or minors), the number of views, and whether it contains profanity. It should be possible to download the table in csv format.
2. Establish a strategy to answer the question preceding multiple cycles of inquiry: could males and females videos have the same interest for the public?
3. Apply the data practices that you have learned using CODAP or Geogebra to answer the question. Paste here the graphs and statistics that you obtain.
4. Answer the question obtained from activity number 3, ensuring that:
 - a you critically interpret the results
 - b you are a healthy skeptic about the AI data that you have analyzed by questioning data origin, identifying gaps or missing variables.
 - c you use a language that helps to understand the uncertainty of the claims that you make.

S12 and S13. Preparing for the debate:

The aim of sessions 10 and 11 is to prepare for the debate:

Is a mixed professional football league viable?

To do this:

1. Participants: The participants will be the members of the class team, where one will act as captain.
2. Interventions:
 - a. In the debate, two class teams will face each other, defending opposing positions (for or against).
 - b. Each team will have four turns (the team of five will have one member who will act as documentation organiser and will be responsible for asking questions to the other team).
 - c. The turns are:
 - **Introduction (2 minutes):** each team will present the thesis they are defending and develop it using the various arguments they deem necessary from those worked on in class (information not developed in class cannot be used).
 - **First rebuttal (3 minutes):** the aim is to contrast the opponent's arguments with your own, dismantling the opposing line of argument in order to construct your own.
 - **Second rebuttal (2 minutes):** the aim is to continue refuting the ideas already put forward that contradict those presented by the other team.
 - **Conclusion (3 minutes):** the conclusion will consist of a summary of the debate by each of the teams, without allowing them to refute or present new arguments or ideas.
3. Rules:
 - a. Each team will decide how its speakers will intervene in each position, with all team members required to participate.

- b. In teams of five members, one of them will have the role of documentarian with the obligation to ask at least one question during the reply or rebuttal round.
 - c. All the rules described in the rubric must be followed in order to obtain the maximum score.
- 4. Each team decides how it will organise the debate and what information it will provide, what it will reply or rebuttal, and what questions it will ask the other team.

S13 and S14. Debate

Paste here all the information that you have prepared for participating in the debate

Portfolio Rubric

Indicator	Weighting	Insufficient	Sufficient	Good	Notable	Outstanding
Organisation and Presentation	5%	Disorganised, difficult to follow; minimal attention to aesthetics.	Basic organisation, somewhat confusing; minimal visual clarity.	Neat, minor errors; generally clear structure.	Clearly structured, good presentation; logical flow.	Very clear, visually appealing, professional; facilitates critical reading and reflection.
Content (Mathematical & Data Criteria)	30%	Assignments missing or incomplete; poor understanding; ignores data limitations.	Includes some work; limited understanding; minimal questioning of results or assumptions.	Includes all assignments; adequate understanding; some evaluation of sources or methods.	All work well-developed; solid understanding; demonstrates critical thinking about data validity and assumptions.	Complete, thorough, accurate; demonstrates mastery; consistently questions assumptions, evaluates AI/data outputs, identifies limitations.
Originality and Creativity	5%	No original ideas; reproduces work without reflection.	Some personal ideas, but poorly developed; limited critique of sources.	Some original solutions and personal approaches; occasional reflection on methodology.	Well-developed creative approaches; integrates critical evaluation of processes and data.	Innovative, creative, unique approaches; consistently demonstrates critical reasoning and independent thinking.

Mathematical/Data Accuracy and Rigour	7%	Frequent errors; lacks rigour; ignores potential data biases.	Some errors; partial understanding; minimal attention to method validity.	Reasonable accuracy; minor errors; some reflection on methodology.	Accurate and rigorous; few inaccuracies; evaluates reliability of methods/data.	Flawless calculations; excellent depth; consistently evaluates and questions assumptions and data sources.
Clarity in Explanations	5%	Confusing explanations; no justification or critical reasoning.	Understandable explanations, superficial; minimal reflection on results.	Clear explanations, partially justified; some critique of assumptions.	Well-justified, coherent, accurate; demonstrates critical evaluation.	Very clear, precise, detailed explanations; explicitly reflects on limitations, uncertainties, and alternative interpretations.
Application of Knowledge	8%	Does not apply concepts appropriately; ignores real-world implications.	Forced or limited applications; limited questioning of outcomes.	Applies correctly in most cases; some consideration of context or limitations.	Applies knowledge fluently; demonstrates thoughtful evaluation of results.	Effectively transfers knowledge to new situations; critically evaluates implications, assumptions, and AI/data limitations.
Creativity in Presentation	5%	Minimal use of visual elements; no reflection on their effectiveness.	Some visual resources; poorly integrated; limited critical annotation.	Basic, adequate use of visuals; some explanatory notes.	Creative, consistent use of graphics, tables; supports critical understanding.	Visually rich, well-integrated; enhances critical interpretation and reflection.

Consistency and Cohesion	5%	Disconnect between works; fragmented arguments.	Some connections ; weak coherence.	Overall coherence; minor gaps.	Fluidity between works; coherent arguments.	Logical, cohesive development; integrates critical reflection and evaluation throughout.
Compliance with Requirements	5%	Does not meet basic requirements.	Partially meets requirements.	Meets essentials; some gaps.	Meets all requirements.	Exceeds requirements; includes additional critical reflections, questioning, or evaluation of AI/data processes.
Critical Evaluation and Skepticism	15%	No evidence of questioning assumptions; blindly accepts results.	Minimal reflection; occasional questioning of outputs or sources.	Some critique of data, AI outputs, or assumptions; limited depth.	Regularly evaluates sources, results, and assumptions; identifies potential biases and limitations.	Consistently demonstrates healthy skepticism ; questions AI/data validity, assumptions, and ethical implications; integrates reflections throughout portfolio.

Rubric for the debate

Aspect to be evaluated (Indicator)	Weighting (%)	Insufficient	Sufficient	Good	Notable	Outstanding
Argumentation & Critical Reasoning	10	Vague or absent arguments; no connection to data, graphs, or sources; no questioning of assumptions.	Some arguments presented, but reasoning is unclear; limited connection to data or interpretation.	Comprehensible arguments; based on some data/graphs; some questioning of assumptions.	Clear, coherent arguments; well-supported by interpreted data; considers reliability and potential biases.	Solid, structured arguments; fully supported by graphs, data, and interpretations; demonstrates critical evaluation and healthy skepticism.
Clarity and Coherence	8	Confusing presentation; inappropriate language; lack of logical flow.	Ideas unclear; some structure but limited coherence; occasional lapses in reasoning.	Comprehensible ideas; generally appropriate language and logical structure.	Clear presentation; logical flow; language facilitates understanding and critical evaluation.	Impeccable clarity; precise language; excellent logical structure; reasoning supports critical reflection.

Evidence and Support	8	No evidence or only unsupported opinions; data ignored or misrepresented.	Some evidence presented but relevance unclear; minimal engagement with data quality.	Most evidence relevant; some integration with arguments; basic reflection on reliability.	Well-selected evidence; uses project data effectively; identifies patterns or inconsistencies.	Highly relevant, accurate evidence; consistently evaluates sources, data quality, and potential biases; strengthens critical argumentation.
Participation & Engagement	7	Minimal or absent participation; little interaction with peers.	Participation unbalanced; some members dominate or are passive.	Adequate participation; occasional engagement in critical discussion.	Everyone participates actively, respectfully; engages in questioning and discussion of evidence.	Equitable, active, constructive participation by all; encourages critical reflection, challenges assumptions, and responds thoughtfully to peers.
Replies and Counter-replies	7	No responses or irrelevant; no engagement with peers' reasoning.	Replies poorly substantiated; minimal depth.	Relevant replies; some engagement with data and arguments.	Most replies clear, reasoned, and relevant; challenge ideas respectfully; reference data/graphs.	Well-thought-out, timely responses and counter-responses; actively evaluates peers' arguments; identifies

						assumptions, errors, or biases.
Introduction / Conclusion	5	Missing or irrelevant; no framing of discussion.	Present but poorly developed; limited context or synthesis.	Both parts present; fulfill basic function.	Clear introduction and conclusion; summarize discussion and reinforce key points; reference data/graphs.	Impactful opening; strong conclusion; frames discussion critically, highlights limitations, and positions arguments thoughtfully.
Use of Time	5	Poor time management; interruptions or excesses; discussion unfocused.	Timing inconsistent; minor lapses.	Time generally adequate; minor discrepancies.	Good time management; adheres to assigned framework.	Excellent time management; flexible and balanced; allows critical discussion and reflection.
Respect and Collaboration	5	Disrespectful; inappropriate language or gestures.	Basic respect; limited collaboration.	Respectful; some non-verbal communication.	Clear respect and collaborative language; gestures support engagement.	Outstanding collaboration; excellent expression, active listening, constructive feedback, and support for critical discussion.

Creativity and Originality

5

No original ideas; repetition of common arguments.

Limited creativity in presenting arguments; minimal engagement with alternative perspectives.

Some original ideas; occasional questioning of assumptions or methods.

Good originality; explores alternative perspectives; introduces critical thinking about data/graphs.

Highly creative, innovative; consistently questions assumptions; proposes novel interpretations or solutions; stimulates critical debate.

Critical Evaluation of Data & AI

10

No engagement with data, graphs, or AI outputs; accepts results without question.

Minimal reflection; limited questioning of sources or reliability.

Some critique of data, graphs, or AI outputs; occasional recognition of bias or uncertainty.

Regular evaluation of data sources, graph interpretation, and AI outputs; identifies potential errors or biases.

Consistently demonstrates critical data literacy and healthy skepticism; questions assumptions, interprets graphs critically, evaluates AI outputs, and reflects on limitations and uncertainties.