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Athletes as guest speakers in mathematics education: A descriptive study of a *pala* player in dialogue with pre-service teachers

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Abstract

The integration of sports-related contexts into mathematics education, along with the inclusion of guest speakers in classroom settings, is a widely acknowledged pedagogical strategy. This study employs a descriptive research approach to analyze a didactic activity conducted with 86 third-year students pursuing a Degree in Primary Education at the University of the Basque Country. The chosen sport for this activity was Basque *pala*, featuring a guest speaker renowned as one of the sport's all-time greats. This activity aimed to enhance the future primary school teachers' capacity to develop and select appropriate mathematical educational materials. Data for this research comprise the mathematical inquiries generated by students' post-guest lectures and responses gathered from a post-session survey. Findings reveal that student participants held a notably favorable perception regarding using Basque *pala* as a mathematical context within primary school education and as a component of their pedagogical training. The involvement of the guest speaker received exceptionally high acclaim. These outcomes remained consistent across two academic years and regardless of respondents' gender. In summary, when introduced by a distinguished practitioner, Basque *pala* proved to be a fertile ground for generating mathematical tasks and was a highly motivating factor for pre-service teachers.

Keywords: Basque *Pala* (Paddle), Guest Speaker, Mathematics Education, Motivation, Primary School

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Mathematics permeates various facets of daily life, encompassing diverse domains. Employing real-world contexts proves invaluable for grasping mathematical concepts (NCTM, 2014), fostering heightened interest among students (Dickinson & Hough, 2012). Establishing connections between mathematics and students' everyday experiences, such as in sports, can significantly enhance their engagement (Nizar et al., 2018; Yansen et al., 2018; Pratiwi et al., 2019; Jannah et al., 2019). In fact, Perger et al. (2018) assert that the optimal approach to teaching mathematics involves furnishing students with meaningful contexts that captivate and incentivize them. In this regard, sports emerge as a domain of considerable educational promise, given their appeal to both children and adolescents.

A significant body of scholarly literature acknowledges the potential of sports as a central axis for cultivating diverse knowledge and skills. For instance, Coral-Mateu (2014) utilized floorball in English instruction within Primary Education settings. Peixoto (2014) employed games and sports to address various areas such as mathematics, Spanish, ICT, and Physical Education. Ramírez et al. (2018)

developed a project-based curriculum integrating numerous sports (e.g., basketball, volleyball, tennis, paddle, skating, cycling, table tennis...) as contexts, revealing enhanced motivation levels among primary education students along with improvements in ICT, linguistic, and motor skills. Van Lierop et al. (2016) explored the bicycle as a means to foster healthy habits among primary school students. PISA-style problems situated within the realm of football (Permatasari et al., 2018), sailing (Efriani et al., 2019), and taekwondo (Rawani et al., 2019) have been utilized to assess mathematics proficiency in Secondary Education, demonstrating increased student motivation when solving problems presented in this manner. Putri and Zulkardi (2020) developed a series of PISA-style mathematics tasks employing the Asian Games as a context to support Indonesian students' learning processes. Overall, sports provide a versatile context that can be integrated into activity design across all educational levels, from primary to graduate, spanning a wide range of subjects, including mathematics (Broich et al., 2014; Cheng et al., 2019; Rodríguez-Martín & Buscà, 2022). Given the established advantages of a sports-based context, this paper delves into the specific possibilities afforded by Basque *pala* as a tool for fostering students' interest in mathematics education.

Basque *pala* (paddle) is a traditional sport originating from the Basque Country and France, representing one of the many modalities within the realm of Basque pelota, a sport currently practiced competitively across various countries such as Spain, France, Italy, Argentina, Chile, Peru, Cuba, and the United States, among others (FIPV, n.d.). In all its variations, players, either individually or in doubles, vie for points in a game reminiscent of squash but played on a larger court typically open on two or three sides. Despite its widespread adoption, pelota maintains a profound connection with Basque society and culture, exemplified by the fronton, the court where the game is played, which holds significant cultural and social significance (González-Abrisketa, 2012). Traditionally, frontons have been spaces predominantly occupied by males; however, there has been a gradual rise in the participation of women in the Basque Country, albeit not yet achieving parity with their male counterparts (Prabucki, 2017). Nevertheless, studies by Fernández-Lasa et al. (2020; 2021) indicate a steady increase in female presence and involvement. Traditional Basque sports and games have long been integrated into Physical Education (PE) curricula (Etxebeste, 2002), with documented didactic potential in this domain (Amenabar, 2001). Despite this, there is no existing record of any pelota modality being utilized for teaching mathematics.

This study was conducted with students enrolled in the Bachelor of Primary Education program at the University of the Basque Country (UPV/EHU). Throughout the initial three years of the program, prospective teachers undergo training in various subject areas, including mathematics education. The fourth and concluding year of the program is focused on a particular area of specialization. Among the four available options for students at the Vitoria-Gasteiz campus, 60% of them opt for the Physical Education minor (Ministry of Education, Culture, and Sport, 2014), indicating a prevalent interest in Physical Education among the enrolled students.

The participants in this study were third-year students enrolled in Mathematics and its Teaching II, a mandatory course instructed by the first author. Among the skills taught in this course is the capacity to generate, choose, and evaluate educational materials that promote meaningful mathematical learning in Primary Education. Consequently, the pedagogical aim of this research was to foster the cultivation of this skill, employing Basque *pala* as a contextual framework. The research objective encompassed documenting the progression of this capability and analyzing the students' perceptions regarding the utilization of guest speakers as a resource in mathematics education.

METHODS

Design

This descriptive research sought to obtain an overview of future primary teachers' capability to create appropriate mathematics education resources. To this end, two classes (one per academic year) within the subject Mathematics and its Teaching II included guest participation by a professional *pala* player. A quantitative analysis of student participants' responses to a post-activity survey was conducted to identify pre-service teachers' perceptions and evaluations of the sessions. Data was segregated by gender and year of enrolment in the subject (Frey, 2018).

Participants

Forty-two students (20 men and 22 women) participated in the first lecture, held in May 2022, and 44 students (13 men and 31 women) participated in the second, held in March 2023. Sixty-two percent of the participants were women, and 38% were men. While the lecture was open to all students enrolled in the subject, participation in the research project was voluntary and confidential. All those choosing to take part granted written informed consent. The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of the UPV/EHU (Treatment code TI0123; 10/05/2019, more information here: https://www.ehu.eus/es/web/idazkaritza-nagusia/-/ti0123, accessed on 27 September 2023).

Procedure and Data Collection

During the 2021/2022 academic year, the first author, responsible for designing and delivering the course Mathematics and its Teaching II, reached out to professional *pala* player Pablo Fusto (known as Fusto). He graciously accepted the invitation to deliver a guest lecture on the topic. The primary objective of this lecture was to elucidate connections between Basque *pala* and mathematics while also motivating prospective teachers to leverage sporting contexts to enhance their future students' mathematical skills. Table 1 outlines the structure of the session.

Table 1. Structure of the Session

No.	Phase	**Length** (minutes)
1	Presentation of the session and introduction of the guest speaker.	10
2	Speakers' presentation.	25
3	Dialogue between the speaker and the students and creation of a teaching resource.	40
4	Evaluation of the session	15

The session began with the first author asking questions like, "Have you heard of *pala*?" "Do you know Fusto?" and "Did you know that mathematics is present in *pala*?" These questions were asked to activate the existing knowledge of the participants, as well as to demonstrate the classroom technique of asking questions to activate and mobilize students' curiosity and motivation before introducing a mathematics task. Generally, the pre-service teachers enrolled in the course were very interested in sports and physical activity and aware of the guest speaker's reputation as among the best *pala* players of all time. Following this initial dynamic, the guest speaker was formally introduced, and the session's objective was explained.

The second part of the class was dedicated to the guest lecture itself. The guest talked about himself, his origin in the sport and subsequent career, memorable matches, different types of frontons, materials, etc. He also brought his own gear to class, and allowed the pre-service teachers to handle it (see Figure 1).

Figure 1. Paddle and Ball used in *Pala*

In the concluding segment of the session, students, arranged in groups of four to five, engaged the guest speaker with inquiries, prompting discussions on incorporating *pala* as a context for mathematical activities. Subsequently, each student group devised a teaching resource tailored for implementation with fifth and/or sixth-grade Primary Education students (aged 10-12). Finally, participants completed a survey assessing their experience, proposed individual questions, and provided additional feedback. One year later, a second session adopting the same structure was conducted with the subsequent cohort of students to augment the sample size.

Post-Activity Survey

A succinct survey was crafted for the pre-service teachers to evaluate the efficacy of the guest lecture. This survey was distributed digitally via Google Forms, and students provided their responses. The questionnaire encompassed items grouped into six distinct areas, as delineated in Table 2.

Table 2. Items Included in the Post-Activity Survey

Area	Items
A1	I1. Rate the contribution of the *pala* player
	I2. Rate the methodology used in the session
	I3. Rate the in-class atmosphere
	I4. Rate student participation
A2	I5. I believe that this type of guest lecture has high didactic value and should be used in primary schools.
A3	I6. I would like to have more guest lectures of this type to work on mathematics in the faculty.
	I7. Which speaker would you invite for a future session?
A4	I8. How difficult would it be for you to implement this type of talk-session as a primary teacher?
A5	I9. Propose a mathematical task for primary school, based on Fusto's guest lecture.
A6	I10. Any further comments.

For items I1-I6 and I8, students offered ratings on a five-point Likert scale. Conversely, items I7, I9, and I10 were open-ended, inviting free-form responses. Statistical analyses, including descriptive statistics, Cronbach's alpha analysis, and Mann-Whitney U contrasts, were conducted using IBM SPSS Statistics 26. Additionally, statistical graphs were generated using Excel 2016.

RESULTS AND DISCUSSION

Creating and Selecting Teaching-Learning Resources for Primary School

During the session held in 2022, participating students gathered in groups of four to five and, based on both Fusto's talk and on the subsequent conversation, created a battery of mathematical tasks.

Table 3. Tasks and learning objectives are included in the teaching-learning resource produced by students in the session held in 2022

No.	Tasks	Learning objectives
1	Where and when was Fusto born?	Develop number sense. Get to know a sport which integrates mathematics through the story of a recognized professional athlete.
2	Calculate his current age.	Develop number sense by working with dates.
3	What equipment does Fusto use to play Basque *pala*?	Identify material used in Basque *pala*, which can be approached from a mathematical perspective (analysis of shape, weight, cost, ...).
4	Using a convenient scale, draw a left-wall fronton, indicating its dimensions (length, height, and width) and the scale used.	Develop spatial sense and identify geometric aspects in a real-world context.
5	Describe three types of paddles used in different modalities of the game and give the length, height, and width in centimeters (cm) and the weight in grams (g) of each.	Understand the meaning of measurement and units, use experimentation by measuring paddles.
6	Describe three types of balls used in different modalities of the sport. Give their weight in grams (g) and diameter in millimeters (mm).	Understand the meaning of measurement and units, use experimentation by measuring the balls.
7	Calculate the volume (cm^3) of the balls to play different *pala* modalities.	Identify the ball as a sphere and apply the formula to calculate volume.
8	Solve the following problem: We are going to buy beginners' paddles and balls for our class. There are 25 of us in total, and we need one ball and one paddle for each person. How much money (euros) do we need to make this purchase?	Solve day-to-day problems, which include operations with quantities.
9	How many Argentine pesos would we need to buy the 25 paddles and balls from the last problem?	Make conversions based on the value of a currency. Use computational tools to identify and use the current exchange rate.

After that, with the instructor's guidance and using some of the students' proposed mathematical tasks, the whole class designed a teaching-learning resource (see Table 3) appropriate for classroom use with fifth and/or sixth-year Primary Education students (aged 10-12).

The teaching-learning resource the participating education students produced consisted of a series of tasks. This set of tasks sought to achieve three objectives: (1) to encourage interest in mathematics through Basque *pala*, (2) to teach some of the concepts, rules, and history of a traditional Basque sport (tasks 1 and 3), and (3) to develop primary school students' mathematical content knowledge (NCTM, 2000). In the session held in 2022, the teaching-learning resource consisted of nine mathematical tasks. Tasks 1, 2, 8, and 9 were designed to work on Numbers and Operations, tasks 4, 5, 6, and 7 were oriented towards *Geometry* and *Measurement*, and questions 1 and 3 were cross-discipline.

Apart from this classroom activity, students contributed individual questions through the post-activity survey, as described above. For the 2022 year group, these questions included the following mathematical tasks: the calculation of areas (paddle, ball, fronton); the measurement of length-height-width and the calculation of the perimeter of frontons where Fusto has played; the calculation of volumes (paddle, ball, fronton); the calculation of the volume of a ball; ordering the balls by weight; calculation of the average weight of paddles and balls shown by Fusto. Most of the questions collected focused on measurement, which may reflect that this content was being taught in the subject when the guest lecture was given. However, some participants suggested questions linked to statistics ("What is the median weight of the three balls shown by Fusto?"), or probability ("Calculate the probability of Fusto winning a match 22-10").

Some of the questions that students proposed needed to be more appropriate, from a curricular point of view, for Primary Education. These included some that required the application of the Pythagorean theorem or other more complex calculations of force and velocity. Other questions were poorly formulated from a mathematical point of view ("Calculate the average of the ball or paddle," "Calculate the average height and weight of the players"). Other questions revealed limitations with respect to knowledge of the sport itself ("Calculate the probability that Fusto wins a match with the result 22-10." The probability is zero since matches are not played to 22 points).

In the following academic year (2023), the procedure was repeated to include a second cohort of students, and the bank of questions was expanded. This group of participants produced some questions that addressed areas that needed to be identified by students in the preceding year. These included questions that dealt with estimation ("Estimate the size of the area reserved to spectators of a given fronton and estimate the spectator capacity, assuming that each person occupies a space of 1 m^2") and ordering with a change of measurement units ("Order the following balls from smallest to largest. Their diameters are: 0.0075 dam – 4.5 cm – 0.57 dm – 62 mm"). Questions related to data analysis, such as the following, were also proposed: "Calculate the percentage of matches that Fusto has won" and "represent the championships that the *pala* player has won on a timeline." Students also devised proposals based on local *pala* courts they knew and on taking actual measurements.

In both 2022 and 2023, the efficacy of the individual questions contributed by students was examined during the Mathematics and its Teaching II session following the guest lecture. Across both cohorts, the guest lecture experience significantly enhanced their pre-service training, fostering the development of their ability to craft teaching-learning resources. This was evidenced by how the questions generated in both sessions facilitated engagement with various aspects encompassed in the Standards for Mathematics Education (NCTM, 2000):

- To understand the numbers and the meanings of the operations, to calculate effectively and estimate accordingly.
- To analyze the characteristics and properties of geometrical forms.
- To understand the measurable attributes of the objects and the units, systems, and measurement

processes.

- To formulate data-driven questions and collect, organize, and visualize the relevant data to answer them.

Space, time, forms, and scoring are mathematical concepts found in sports practice (Gallian, 2010). These concepts are also integral to the Primary Education curriculum (NCTM, 2014). Some students proposed questions centered on numerical operations or data analysis and probability, although refinement of the wording was necessary in some instances. The most prevalent questions focused on applying techniques, tools, and formulas for calculating measurements such as length, area, volume, and mass pertinent to the materials or spaces utilized in *pala* sports. This prevalence stemmed from students' identification of various geometric shapes and their estimations of the dimensions of these materials during their interaction with the materials provided by the *pala* player in the classroom. While existing research underscores the interconnectedness of sports and mathematics (Castellano et al., 2016; Eastaway & Haigh, 2021), no prior work documents the utilization of *Pala* as a foundation for generating didactic materials.

Pre-Service Teachers' Rating and Perceptions of the Use of A Guest Lecture on Basque *Pala* in Mathematics Education

As described in the methodology, participating students completed a survey at the end of each session to rate their experience and share their perceptions. A Cronbach's alpha analysis (α = 0.75) allowed to accept the survey consistency (Field, 2013; Taber, 2018).

Results Concerning Guest-Speaker Contribution, Session Methodology, Student Participation, and In-Class Atmosphere

As shown in Figures 2 and 3, students rated the intervention by the invited athlete very highly, as well as the methodology used, the in-class atmosphere, and their own participation (area A1, items I1-I4). Regarding students' participation ratings, while the assessment was generally positive, they believed that their participation could have been more active.

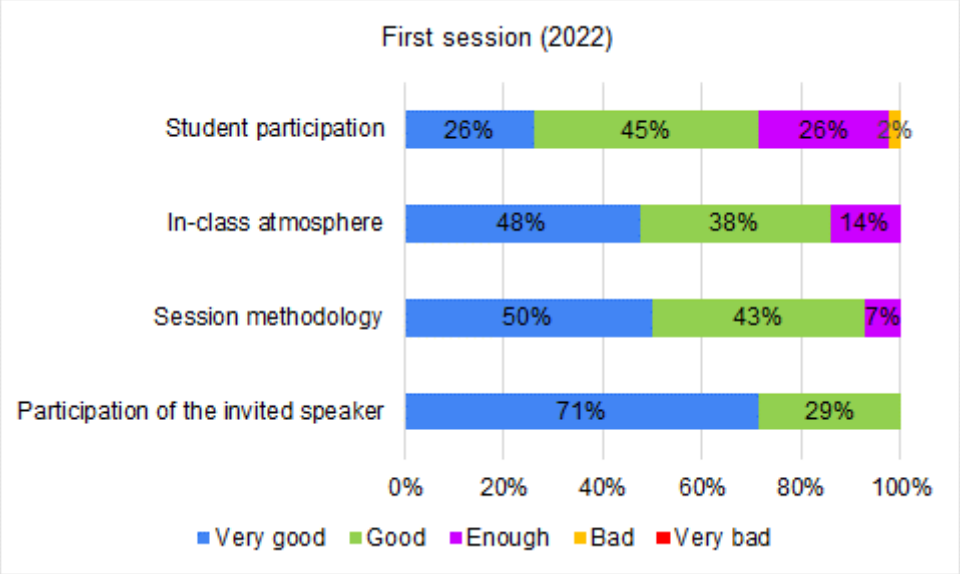

Figure 2. Satisfaction regarding the invited speaker, session methodology, classroom atmosphere and student participation (n = 42) for the first session (2022)

Figures 2 and 3 depict a predominantly positive evaluation. Across both figures, the contribution of the guest speaker receives notably higher ratings than other aspects. Nevertheless, the methodology employed also garnered high praise, with a comparable number of "Good" and "Very Good" responses. Conversely, aspects such as the in-class atmosphere and student participation were identified by participating students as areas for potential improvement.

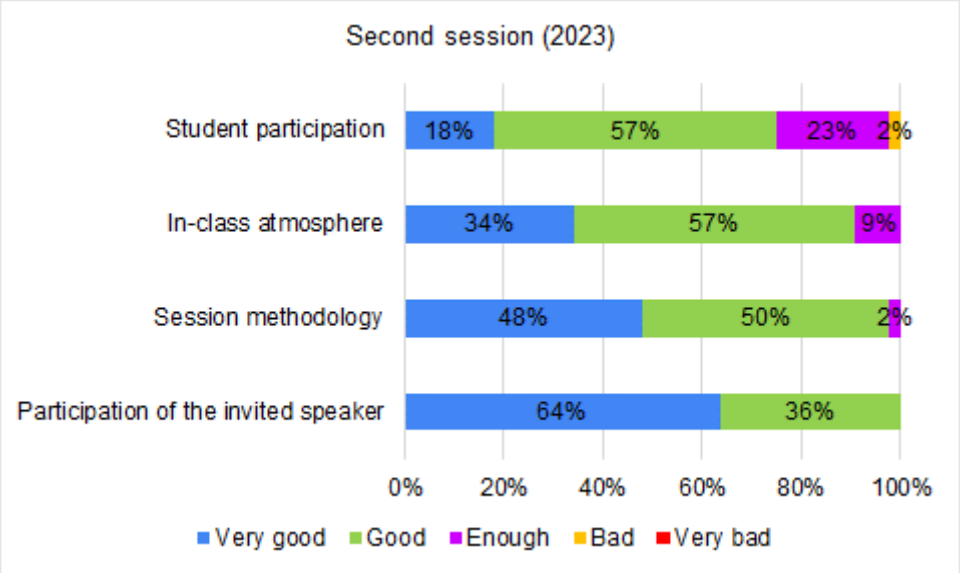

Figure 3. Satisfaction regarding the invited speaker, session methodology, classroom atmosphere, and student participation (n = 44) for the second session (2023)

The results were analyzed quantitatively by using descriptive statistical analysis. Table 4 shows the maximum, minimum, median, arithmetic mean, and standard deviation for each item shown in Figures 2 and 3, rated on a 5-point Likert scale (from 1—Very bad to 5—Very good).

Table 4. Descriptive statistical analysis of the assessment of the sessions (items 1-4).

	Participation of the guest speaker		Session methodology		In-class atmosphere		Student participation	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
Minimum	4.00	4.00	3.00	3.00	3.00	3.00	2.00	2.00
Maximum	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Median	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00
Arithmetic mean	4.71	4.64	4.36	4.45	4.33	4.25	3.95	3.91
Standard deviation	0.46	0.49	0.62	0.55	0.72	0.62	0.80	0.71

As shown in Table 4, of the four aspects assessed, the highest rating was given to the guest speaker. This confirms the findings of other research (Lorenzi, 2009; Merle & Craig, 2017; Dalakas, 2016; Kong, 2018), which shows that including guest speakers improves student motivation and benefits the learning process. In the first two sessions, the minimum score (4), median (5), and arithmetic mean (4.71 and 4.64) were higher for the participation of the speaker than to the other aspects, with a higher concentration with respect to the arithmetic mean (4.71 ± 0.46 and 4.64 ± 0.55, respectively). The session

methodology was also rated positively, 4.36 ± 0.62 y 4.45 ± 0.55 in each session, respectively. While the classroom atmosphere was also rated positively, ratings were more dispersed, situated between 4.33 ± 0.72 and 4.25 ± 0.62 in each session, respectively. The mean values for student participation were lower, and the deviation was higher (3.95 ± 0.80 y 3.91 ± 0.71 in each session, respectively).

Guest Speakers in Primary Schools as A Didactic Tool

Item I5, which stated, "I believe that this type of guest lecture has high didactic value and should be used in primary schools" (area A2), garnered significant participant support. As illustrated in Figure 4, in the pie chart on the left, 71% of students from the first session strongly agreed, while the remaining 29% agreed with the statement. Similarly, in the second session, depicted in the pie chart on the right, except for two participants (4%) who neither agreed nor disagreed, the remaining 96% either strongly agreed (80%) or agreed (16%). This demonstrates that the vast majority of students, based on their experience of the guest lecture focused on *pala* conducted within the subject, strongly supported employing guest speakers to integrate sporting contexts to develop mathematical skills in primary education.

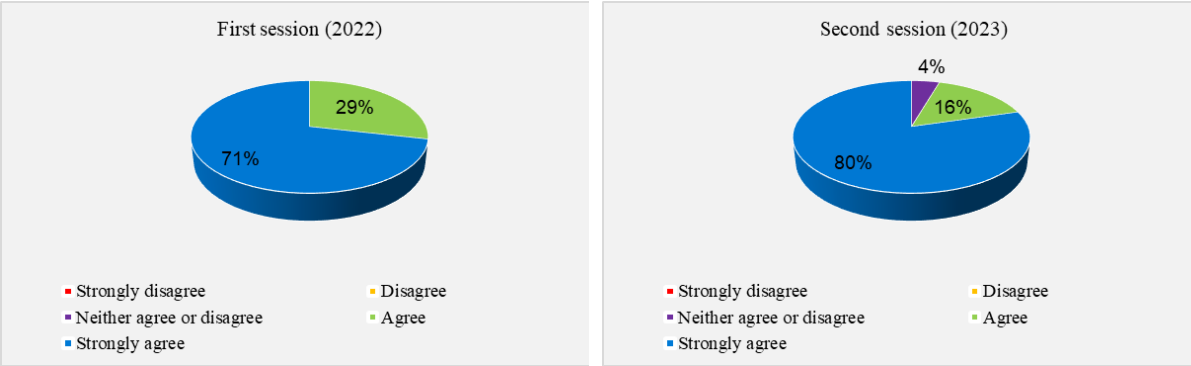

Figure 4. Responses to item I5, "I believe that this type of guest lecture has high didactic value and should be used in primary schools" for the first session (2022) and the second session (2023).

Teachers wield considerable influence over student motivation, a pivotal element in fostering student engagement within the teaching-learning process (Adler et al., 2018). Part of this responsibility entails selecting captivating problems situated within relevant and suitable contexts (Cheng, 2013). This necessitates the practical application of the established principle that contextual factors can heighten student engagement and enhance learning outcomes (Kapon, 2016). In this regard, the guest *pala* player notably impacted student engagement. During his lecture, he underscored that the values guiding his athletic journey align with those emphasized in the official mathematics education curriculum, particularly in problem-solving. Concrete examples include "confidence in one's abilities," "initiative and resilience in the face of learning challenges," "commitment and perseverance," and "active participation in collaborative efforts" (Order EFP/678/2022, p.127). Exploring the significance of the guest lecturer explicitly bridging his own athletic endeavors with educational content presents a promising avenue for future research.

Interest in Receiving More Sessions of This Type to Learn Mathematics in the Faculty

Generally, respondents stated that they would like to receive more guest lecture sessions (area A3). As shown in Figure 5, following the first session (2022), almost three-quarters of the responses to item I6, "I would like to have more guest lectures of this type to work on mathematics in the faculty", were "Strongly

agree" (74%) or "Agree" (26%). In the second session, 94% of the participants strongly agreed (64%) or agreed (30%) with this statement; only 2% disagreed, and 4% were undecided (“Neither agree nor disagree”).

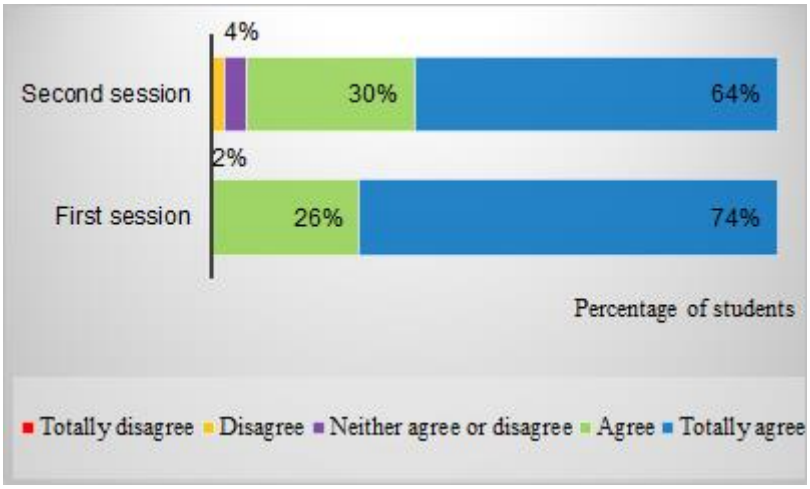

Figure 5. Answers to I6, “I would like to have more guest lectures of this type to work on mathematics in the faculty”

Regarding item I7, "Which speaker would you invite for a future session?" after the first session, 76% of respondents expressed a preference for inviting another athlete, while 14% indicated they would opt for a speaker from a different field (such as science) or of another gender (woman), and the remaining 10% were undecided. In the second session, 91% of student participants indicated they would choose to invite another athlete, 7% preferred a woman, and 2% suggested an artist. This aligns with findings from existing research (Caukin & Brinthaupt, 2017; Jablon-Roberts & McCracken, 2022), suggesting that student participants greatly appreciated the session with the professional *pala* player and perceived it as a valuable component of their training as pre-service teachers.

Difficulties in Implementing This Type of Session as A Primary Teacher

Responses to item I8, "How difficult would it be for you to implement this type of talk-session as a primary teacher?" exhibited more notable discrepancies between the two cohorts. Figure 6 illustrates that students who participated in the first session (2022) expressed a greater sense of confidence in their ability to implement similar sessions in a school setting compared to participants in the second session (2023).

In the 2022 cohort, 93% of students believed they would encounter little difficulty in implementing such sessions, while only 7% anticipated severe problems. In contrast, among the 2023 cohort, 14% anticipated some difficulty, another 14% thought they would face serious difficulty, and the percentage of students expecting little difficulty decreased notably to 73%. Similarly, the proportion of students who perceived it as easy to implement this type of session was more than twice as high in 2022 (10%) compared to 2023 (4%). While the question of what factors contribute to these differences is intriguing, it falls outside the scope of this paper.

Finally, it's noteworthy that there was no perception among students that implementing this type of session would be impossible. This suggests that, overall, students viewed themselves as capable of leading a teaching experience akin to the one they encountered in a Primary Education classroom.

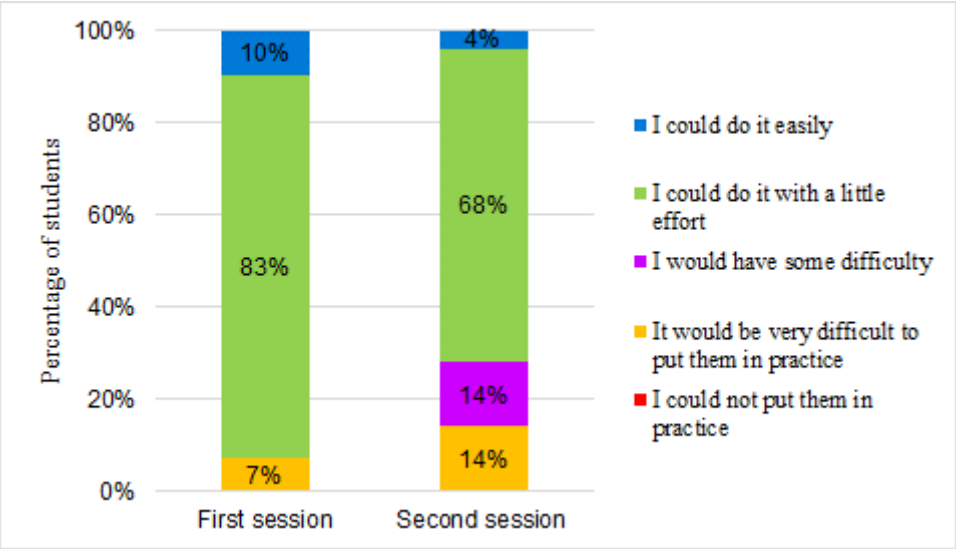

Figure 6. Answers to I8, "What degree of difficulty would you have to implement this type of guest lecture as a primary teacher?"

Individual Work and Additional Remarks

In the final section of the survey, students were invited to propose a question relevant to mathematics education based on Fusto's guest lecture and the ensuing dialogue (item I9), along with providing any additional remarks (item I10). This section served to expand the pool of questions and gather further insights. Among the collected comments were expressions such as: "It's been really interesting," "I have really enjoyed working on an activity like this in class," or "I didn't know up until now how to connect mathematics and sports and Fusto's talk gave me a lot of ideas." These comments from participating students corroborate findings from research by Metrejean et al. (2002), indicating that students derive enjoyment and benefit from guest speaker sessions. Furthermore, the results align with existing research demonstrating that the utilization of a sporting context enhances students' attitudes towards learning mathematics, both at the university level (Robinson, 2012) and in primary school settings (Sanchal & Sharma, 2017).

Comparative Analysis by Cohort and Gender

A Mann-Whitney U test was used to analyze whether there was any significant difference between the responses given by each group at a significance level of 5%.This test was chosen after using the Kolmogorov-Smirnov test, which showed that variables were not normally distributed. Table 5 shows the results obtained:

Table 5. Mann-Whitney U contrast of the variables analyzed with respect to the session

	Participation of the guest speaker	Session methodology	In-class atmosphere	Student participation	Didactic usefulness in schools (Primary Ed.)	Interest to receive these types of lectures to learn math at the university level	Difficulty to put into practice as a teacher
M-W U	852.000	856.500	842.000	895.000	777.000	834.000	722.000
p-value	0.443	0.510	0.435	0.785	0.129	0.342	0.020

The p-values exceeding the significance level of 0.05 indicate a null hypothesis, suggesting no significant differences between the responses obtained in the first session (2022) and the second session (2023) for most questions. The sole meaningful difference detected (p-value 0.02 < 0.05) pertained to the perceived difficulty level reported by students regarding the implementation of such sessions in their teaching careers. Notably, students from the first session exhibited greater confidence, as also depicted in Figure 6. Additionally, a Mann-Whitney U test was conducted to explore the potential for significant differences in perceptions among pre-service teachers based on gender, as presented in Table 6:

Table 6. Mann-Whitney U contrast of the variables analyzed with respect to gender

	Participation of the guest speaker	Session methodology	In-class atmospheret	Student participation	Didactic usefulness in school (Primary Ed.)	Interest to receive these types of lectures to learn math at the university level	Difficulty to put it into practice as a teacher
M-W U	863.500	866.500	743.000	798.500	840.500	782.000	834.500
p-value	0.904	0.936	0.198	0.462	0.718	0.315	0.637

Several studies have identified gender disparities in attitudes and motivation toward sports that manifest during school age (Kudlacek et al., 2020; O'Reilly et al., 2023). Traditionally, girls are encouraged to participate in sports like dance or tennis, while boys gravitate toward activities like football or rugby (Yungblut et al., 2012). Basque *pala* also adheres to the stereotype of being part of the "masculine" domain of sports (Prabucki, 2017). However, despite these gender norms, the p-values derived from the Mann-Whitney U contrast, as shown in Table 6 (all exceeding the significance level), indicate no significant differences by gender for any survey items at a 5% significance level. Overall, students expressed highly positive evaluations of the sessions, with consistency observed across both gender and enrollment cohorts.

CONCLUSION

This paper demonstrates two primary findings. Firstly, it illustrates that a guest lecture delivered by a Basque *pala* player to education students established the sport as a viable context for creating classroom materials to develop mathematical proficiency at the primary school level. Pre-service teachers actively engaged in developing didactic materials during class sessions and contributed individually to a bank of questions. Secondly, participating students overwhelmingly endorsed the guest lecture as a valuable pedagogical approach applicable to their future careers as primary school teachers. They rated the contribution of the guest speaker highly, with additional comments affirming the efficacy of guest speakers, particularly athletes. This favorable reception can likely be attributed to the speaker's adeptness, as Fusto tailored his presentation to address the presence of mathematics within his sport directly. Furthermore, his ability to identify common values shared between mathematical problem-solving and elite-level athletic performance-inspired students to recognize and apply mathematical concepts in a non-mathematical context.

Participation in the guest lecture experience was a tangible instance of pedagogical experimentation for pre-service students. This experience inspired them and broadened their horizons,

fostering an enhanced ability to generate materials rooted in real-world contexts. This amalgamation of inspiration, motivation, and skill-building significantly developed their professional competence.

Regarding limitations in the research, while the data collected indicates that students rated the experience very positively, it needs to be evaluated systematically for its impact on their abilities. Additionally, the experience was conducted with university students rather than primary education students. Future research endeavors could focus on implementing and evaluating teaching resources that integrate *pala* and mathematics within primary schools and examine the potential impact of guest lecturers in this context. This would involve exploring how utilizing *pala* as a contextual framework could influence school pupils' attitudes toward learning mathematics, particularly when integrated with instruction in the sport itself.

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Declarations

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REFERENCES

Adler, I., Schwartz, L., Madjar, N., & Zion, M. (2018). Reading between the lines: The effect of contextual factors on student motivation throughout an open inquiry process. *Science Education,102*(4), 820-855. https://doi.org/10.1002/sce.21445

Amenabar, B. (2001). Euskal Pilotako Joko Zaharren azterketa eta aplikazio didaktikoa. *Jentilbaratz 7,* 167-175. https://www.eusko-ikaskuntza.eus/PDFAnlt/jentil/07/07167175.pdf

Broich, H., Mester, J., Seifriz, F., & Yue, Z. (2014). Statistical analysis for the First Bundesliga in the current soccer season. *Progress in Applied Mathematics*, *7*(2), 1-8. http://dx.doi.org/10.3968/4886

Castellano, R., Huestamendia, G., & Toboso, C. (2016). *Matemáticas en el deporte (Mathematics in sport).* Spanish Federation of Societies of Mathematics Teachers.

Caukin, N. G., & Brinthaupt, T. M. (2017). Using a teaching philosophy statement as a professional development tool for teacher candidates. *International Journal for the Scholarship of Teaching and Learning, 11(2),* Art. 18. https://doi.org/10.20429/ijsotl.2017.110218

Cheng, D., Berezovski, T., & Talbert, R. (2019). Dancing on ice: Mathematics of blade tracings. *Journal of Mathematics and the Arts, 13,* 112-130. https://doi.org/10.1080/17513472.2018.1509259

Cheng, L. P. (2013). The design of a mathematics problem using real-life context for young children. *Journal of Science and Mathematics Education in Southeast Asia*, *36*(1), 23-43. http://hdl.handle.net/10497/19391

Coral-Mateu, J. (2014). Physical education and English integrated learning: How school teachers can develop PE-in-CLIL programmes. *Temps d'Educació*, *45*, 41-64. https://www.raco.cat/index.php/TempsEducacio/article/download/274635/362665/0

Dalakas, V. (2016). Turning guest speakers' visits into active learning opportunities. *Atlantic Marketing Journal*, *5*(2), 93-99. https://digitalcommons.kennesaw.edu/amj/vol5/iss2/7

Dickinson, P., & Hough, S. (2012). *Using realistic mathematics education in UK classrooms*. Centre for Mathematics Education, Manchester Metropolitan University.

Eastaway, R., & Haigh, J. (2021). *The hidden mathematics of sport*. Portico.

Efriani, A., Putri, R. I. I., & Hapizah. (2019). Sailing context in PISA-like mathematics problems. *Journal on Mathematics Education*, *10*(2), 265-276. https://doi.org/10.22342/jme.10.2.5245.265-276

Etxebeste, J. (2002). Aisiaren bi euskal kontzeptu: Jokoa eta jolasa. XV Basque Studies Congress: Basque science and culture, and telematic networks. *Euskal Ikaskuntza,* 277-283.

Fernandez-Lasa, U., Usabiaga, O., Lozano-Sufrategui, L., & Drew, K. J. (2021). Negotiating alternative femininities? Gender identity construction in female Basque pelota players. *Sport, Education, and Society*, *26*(2), 188-201. https://doi.org/10.1080/13573322.2019.1710699

Fernandez-Lasa, U., Usabiaga, O., & Soler, S. (2020). Juggling on the court: Exploring female Basque pelota players' experiences and empowerment strategies. *Journal of Gender Studies, 29*(5), 496-507. https://doi.org/10.1080/09589236.2019.1618703

FIPV, International Federation of Basque Pelota. (n.d.). *Modalities*. https://fipv.net/

Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. Sage Publications Limited.

Frey, B. B. (Ed.). (2018). *The SAGE encyclopedia of educational research, measurement, and evaluation.* Sage Publications. https://doi.org/10.4135/9781506326139

Gallian, J. A. (2010). *Mathematics and sports* (Dolciani Mathematical Expositions, Series Number 43). American Mathematical Society.

González-Abrisketa, O. (2012). *Basque pelota: A ritual, an aesthetic.* Reno: Center for Basque Studies.

Jablon-Roberts, S., & McCracken, A. (2022). Undergraduate student perceptions of industry guest speakers in the college classroom. *Journal of the Scholarship of Teaching and Learning*, *22*(3), 76-88. https://doi.org/10.14434/josotl.v22i3.32317

Jannah, R. D., Putri, R. I. I., & Zulkardi. (2019). Soft tennis and volleyball context in Asian Games for PISA-like mathematics problems. *Journal on Mathematics Education*, *10*(1), 157-170. https://doi.org/10.22342/jme.10.1.5248.157-170

Kapon, S. (2016). Doing research in school. Physics inquiry in the zone of proximal development. *Journal of Research in Science Teaching*, *53*(8), 1172-1197. https://doi.org/10.1002/tea.21325

Kong, K. (2018). Different voices: guest speakers as pedagogy in a culture class. In Emmanuel Jean-Francois (Ed.) *Transnational Perspectives on Innovation in Teaching and Learning Technologies* (pp. 262-284). Brill.

Kudlacek, M., Fromel, K., & Groffik, D. (2020). Associations between adolescents' preference for fitness activities and achieving the recommended weekly level of physical activity. *Journal of Exercise Science & Fitness*, *18*(1), 31-39. https://doi.org/10.1016/j.jesf.2019.10.001

Lorenzi, D. G. (2009). Should disability sports be included in the general physical education curriculum? *Journal of Physical Education, Recreation & Dance*, *80*(5), 13-14. https://doi.org/10.1080/07303084.2009.10598319

Merle, P. F., & Craig, C. (2017). Be my guest: A survey of mass communication students' perception of guest speakers. *College Teaching*, *65*(2), 41-49. https://doi.org/10.1080/87567555.2016.1232691

Metrejean, C., Pittman, J., & Zarzeski, M. T. (2002). Guest speakers: Reflections on the role of accountants in the classroom. *Accounting Education*, *11*(4), 347-364. https://doi.org/10.1080/0963928021000031466

Ministry of Education, Culture and Sport. (2014). Informe de Verificación del Grado de Educación Primaria de la Universidad del País Vasco (UPV/EHU). [Verification Report of the Degree in Primary Education of the University of the Basque Country (UPV/EHU)]. https://gestion-alumnos.ehu.es/tmp/Memoria%20Verificada%2007-07-14.pdf

NCTM, National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* National Council of Teachers of Mathematics. https://www.nctm.org/Standards-and-Positions/Principles-and-Standards/

NCTM, National Council of Teachers of Mathematics. (2014). *Principles to actions: Ensuring mathematical success for all*. National Council of Teachers of Mathematics. https://www.nctm.org/Store/Products/Principles-to-Actions--Ensuring-Mathematical-Success-for-All/

Nizar, H., Putri, R. I. I., & Zulkardi. (2018). PISA-like mathematics problem with karate context in Asian Games. *Journal of Physics: Conference Series, 1088*(1), 012063. https://doi.org/10.1088/1742-6596/1088/1/012063.

Order EFP/678/2022, of July 15, which establishes the curriculum and regulates the organization of Primary Education within the scope of management of the Ministry of Education and Vocational Training. *Official State Bulletin*, *174*, July 21, 2022. https://www.boe.es/buscar/pdf/2022/BOE-A-2022-12066-consolidado.pdf

O'Reilly, M., Talbot, A., & Harrington, D. (2023). Adolescent perspectives on gendered ideologies in physical activity within schools: Reflections on a female-focused intervention. *Feminism & Psychology, 33*(2), 175-196. https://doi.org/10.1177/09593535221109040

Peixoto, L. (2014). Interdisciplinary project, "School: Olympic Community". *Retos*, *25*, 140-143. https://doi.org/10.47197/retos.v0i25.34499

Perger, P., Major, K., & Trinick, R. (2018). Adding to, not taking away: Mathematics and music in the primary classroom. *Teachers and Curriculum, 18*(1), 19-25. https://doi.org/10.15663/tandc.v18i1.317

Permatasari, R., Putri, R. I. I., & Zulkardi. (2018). PISA-like: Football context in Asian games. *Journal on Mathematics Education*, *9*(2), 271-280. https://doi.org/10.22342/jme.9.2.5251.271-280

Prabucki, B. (2017). Small nation, big sport: Basque ball–its past and present cultural meanings for the Basques. *The International Journal of the History of Sport*, *34*(10), 943-956. https://doi.org/10.1080/09523367.2017.1415328

Pratiwi, I., Putri, R. I. I., & Zulkardi. (2019). Long jump in Asian games: Contexts of PISA-like mathematics problems. *Journal on Mathematics Education*, *10*(1), 81-92. https://doi.org/10.22342/jme.10.1.5250.81-92.

Putri, R. I. I. & Zulkardi. (2020). Designing PISA-like mathematics task using Asian games context. *Journal on Mathematics Education*, *11*(1), 135-144. http://doi.org/10.22342/jme.11.1.9786.135-144

Ramírez, V., Padial, R., Torres, B., Chinchilla J. L., & Cepero, M. (2018). Consecuencias en la competencia digital del alumnado de primaria de un programa de educación física usando la metodología ABP [The moderating effect of a PBL-based physical activity program on primary students' digital competence]. *Journal of Sport and Health Research*, *10*(3), 361-372. http://www.journalshr.com/papers/Vol%2010_N%203/JSHR%20V10_3_4.pdf

Rawani, D., Putri, R. I. I., & Hapizah. (2019). PISA-like mathematics problems: Using taekwondo context of Asian games. *Journal on Mathematics Education*, *10*(2), 277-288. https://doi.org/10.22342/JME.10.2.5243.277-288

Robinson, C. L. (2012). Using sport to engage and motivate students to learn mathematics. *Teaching Mathematics and Its Applications*, *31*(1), 49–56. https://doi.org/10.1093/teamat/hrr030

Rodríguez-Martín, B., & Buscá, F. (2022). Mathematical competence development in primary school physical education contexts. *International Journal of Medicine and Science of Physical Activity and Sport*, *22*(88), 807-825. https://doi.org/10.15366/rimcafd2022.88.006

Sanchal, A., & Sharma, S. (2017). Students' attitudes towards learning mathematics: Impact of teaching in a sporting context. *Teachers and Curriculum,* *17*(1), 89–99. https://doi.org/10.15663/tandc.v17i1.151

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, *48*, 1273-1296. https://doi.org/10.1007/s11165-016-9602-2

Van Lierop, D., Bebronne, M., & El-Geneidy, A. (2016). Evaluating a bicycle education program for children: Findings from Montreal, Canada. Paper to be presented at the 95th 44 Annual Meeting of the Transportation Research Board, Washington D.C., USA. https://tram.mcgill.ca/Research/Publications/Cycliste%20averti.pdf

Yansen, D., Putri, R. I. I., & Zulkardi. (2018). Mathematical problems of PISA-like with the 200m swimming contexts in Asian games. *Journal of Physics: Conference Series*, *1088*(1), 012086. https://doi.org/10.1088/1742-6596/1088/1/012086.

Yungblut, H. E., Schinke, R. J., & McGannon, K. R. (2012). Views of adolescent female youth on physical activity during early adolescence. *Journal of Sports Science & Medicine,* *11*(1), 39-50. https://www.jssm.org/volume11/iss1/cap/jssm-11-39.pdf