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## Anatomical Canasta: A Pedagogical Game for Teaching Human Anatomy

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### ABSTRACT

Human anatomy is still a subject that teachers have the most difficulty in breaking with the traditional teaching model. The extensive content, which must be memorized in a short period of time, makes teaching monotonous and uninteresting from the students' point of view. Classroom games thus comprise a support tool to make the teaching process dynamic, fun, and enjoyable. This article had as aims the development and evaluation of a pedagogical game to support the learning of muscles and joints involved in shoulder movements for undergraduate students in the health area, consisting of an experience report employing a qualitative and quantitative approach. Data were generated through an anonymous and voluntary online questionnaire consisting of nine closed and three open questions, as well as field notes written by the teacher. A content analysis was applied for the open-ended questions and the Mean Ranking calculation for closed-ended questions on a Likert Scale. A total of 120 students participated in the research. A deck of cards was developed presenting rules adapted from the traditional card game "Canasta" in which students should form a sequence with the cards of the muscles of each joint movement. The results indicated that the "Anatomical Canasta" card game proved to be a motivating and promising strategy for anatomy learning, providing a playful, relaxed and fun class, and was positively evaluated by most participants.

### KEYWORDS

Higher education. Anatomy. Didactic Game. Ludicity.

## Canastra Anatômica: Um Jogo Pedagógico para o Ensino de Anatomia Humana

### RESUMO

A anatomia humana ainda é uma disciplina que os professores apresentam mais dificuldades em romper com o modelo tradicional de ensino. O conteúdo extenso e que deve ser memorizado em um curto espaço de tempo, torna o ensino monótono e desinteressante do ponto de vista dos alunos. O jogo em sala de aula entra como uma ferramenta de apoio, com o intuito de tornar o processo de ensino dinâmico, divertido e prazeroso. Este artigo teve como objetivos o desenvolvimento e a avaliação de um jogo pedagógico para dar suporte ao aprendizado dos músculos e articulações envolvidos nos movimentos do ombro, aos graduandos da área da saúde. Trata-se de um relato de experiência com abordagens quantitativas e qualitativas. A geração de dados ocorreu por meio de um questionário on-line respondido de forma anônima e voluntária, com nove perguntas fechadas e três abertas, assim como as notas de campo redigidas pela professora. Utilizou-se a análise de conteúdo para as questões abertas e o cálculo de Ranking Médio para questões fechadas em Escala de Likert. Participaram da pesquisa 120 alunos. Foi desenvolvido um baralho, com regras adaptadas do tradicional jogo de cartas chamado “Canastra”, no qual os alunos devem formar uma sequência com as cartas dos músculos de cada movimento articular. Os resultados indicaram que o jogo de cartas “Canastra Anatômica” se mostrou uma estratégia motivadora e promissora para o aprendizado de anatomia, proporcionando uma aula lúdica, descontraída e divertida, sendo avaliado positivamente pela maioria dos participantes.

### PALAVRAS-CHAVE

Ensino superior. Anatomia. Jogo didático. Ludicidade.

## Canasta Anatómica: Un Juego Pedagógico para la Enseñanza de la Anatomía Humana

### RESUMEN

La anatomía humana sigue siendo una asignatura que los profesores tienen más dificultades para romper con el modelo tradicional de enseñanza. El extenso contenido, que debe ser memorizado en poco tiempo, hace que la enseñanza sea monótona y poco interesante desde el punto de vista de los alumnos. El juego en el aula se presenta como una herramienta de apoyo, para hacer que el proceso de enseñanza sea dinámico, divertido y ameno. Este artículo tuvo como objetivos el desarrollo y la evaluación de un juego pedagógico para apoyar el aprendizaje de los músculos y las articulaciones involucradas en los movimientos del hombro, para estudiantes de pregrado en el área de la salud. Se trata de un informe de experiencia con un enfoque cualitativo-cuantitativo. Los datos se generaron a través de un cuestionario online anónimo y voluntario, con nueve preguntas cerradas y tres abiertas, así como con notas de campo escritas por el profesor. Se utilizó el análisis de contenido para las preguntas abiertas y el cálculo de la clasificación media para las preguntas cerradas en escala de Likert. Un total de 120 estudiantes participaron en la investigación. Se elaboró una baraja de cartas, con reglas adaptadas del tradicional juego de cartas llamado "Canasta", en la que los alumnos debían formar una secuencia con las cartas de los músculos de cada movimiento articular. Los resultados indicaron que el juego de cartas "Canasta Anatómica" resultó ser una estrategia motivadora y prometedora para el aprendizaje de la anatomía, proporcionando una clase lúdica, relajada y divertida, siendo evaluada positivamente por la mayoría de los participantes.

### PALABRAS CLAVE

La educación superior. Anatomía. Juego didáctico. La lúdica.

### CRediT

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## 1 Introduction

Anatomy teaching involves a vast content and is characterized by the presentation of extensive terminologies that must usually be learnt within a short period of time. The contents are often addressed by teachers in a decontextualized and fragmented manner, with the expectation that the student will simply receive the presented information and reproduce it when requested to do so, to obtain approval at the end of the subject study period (TALAMONI; SISDELI, 2017). The use of more conventional pedagogical approaches, with a low workload for the amount of content, may comprise one of the triggers for low student anatomy subject performance and high dropout rates. In this regard, the applied methodology can directly reduce dropout rates when comprising attractive content and methodologies for anatomy teaching and learning (PIAZZA; CHASSOT, 2011).

In its origin, “[...] human anatomy was academic, a purely descriptive science, mainly interested in identifying and naming body structures (VAN DE GRAAFF, 2003, p.2)”. Currently, the study of anatomy is based on a functional and practical approach, that, when applied, results in the understanding of body physical performance and health (VAN DE GRAAFF, 2003). Anatomy is part of the entire understanding of the human body, and it is impossible to teach anatomy without integrating it with other disciplines (WILLIAMS et al., 1995). The applied approach should be interdisciplinary and the study of anatomical content “[...] should not be limited to the memorization of morphological structures, but instead should focus on developing skills that favor meaningful and permanent learning, with the teacher acting as a mediator in this process.” (RAMOS; TEIXEIRA; BELÉM, 2020, p. 329).

Active learning methodologies emerge as an option for teachers to encourage students to take a leading role.

Active methodologies encompass a conception of the teaching and learning process that considers the effective participation of students in the construction of their knowledge, valuing the different ways in which they can be involved in this process so that they may learn better, at their own pace, time, and style. The students and the relationships they establish with the educator, with peers and, mainly, with the object of knowledge, are at the center in this conception. (BACICH; MORAN, 2018, p. 23)

For Mattar (2017, p. 22), active methodologies make the student transfer from a mere receiver to a “[...] decision-maker, creator, player, teacher, actor, researcher and so on; somehow, they cease to be students [...]” and begin to effectively participate in the teaching and learning process. Thus, the importance of using active methodologies in the classroom that stimulate creativity and problem solving is increasingly highlighted, allowing students to apply their skills and develop the ability to work as a team (SANTOS et al., 2019). Contemporary laboratories appear as an option in this regard, comprising modern spaces in which knowledge is built alongside the students. Anatomy laboratories, in addition to being the place where practical classes are given with human skeletons and formalized cadaveric parts, consist of an ideal environment for collaborative learning in small groups and for experimenting with new teaching methods (HILL; NASSRALLAH, 2018).

Playful, interactive activities are increasingly developed in these laboratories, seeking to establish interdisciplinary teaching (OLIVEIRA et al., 2018). In addition to the importance of play, enriching and humanizing the teaching-learning process of university students (RIBEIRO; BONINI; MELLO, 2019), several studies have highlighted the relevance of educational games when dealing with the topic of anatomy in higher education (PEREIRA; FIUZA; LEMOS, 2019; SILVA; MELO, 2019; SILVA; GUIMARÃES; BARBOSA, 2006). Therefore, games seem to fit in this context as an active learning tool.

In this context, the development of an educational game is viable as a proposal for a playful and attractive active methodology teaching-learning process of Human Anatomy (SILVA; MELO, 2019). “Its playful characteristic can comprise an influencing factor in student adherence, as they reproduce a relaxed atmosphere in the classroom that is experienced in their leisure time.” (SANTOS et al., 2019, p. 3348). Motz et al. (2019) also recognize the pedagogical value of games in the learning of human physiology and anatomy, considering them as an effective tool capable of reaching students of different learning styles and translating student engagement into play. Frageli (2018) reported an experience with physiotherapy undergraduates and concluded that games can be an interesting strategy to favor the learning of content considered more difficult and of little interest to students.

Pereira, Fiuza and Lemos (2019) analyzed several articles on anatomy teaching and reported the wide use of games in education, indicating that can comprise excellent instructional tools, as they entertain, motivate, and facilitate learning, in addition to increasing the retention capacity of what has been taught. The authors conclude that applying games as a teaching method can improve deep learning and increase student interest.

Given the above, this study aimed to develop the pedagogical game "Anatomical Canasta", as a teaching tool to facilitate the understanding of the action of the muscles involved in each joint movement of the shoulder complex. As specific objectives, we aimed to describe the construction and evaluation stages of the game.

## 2 Methods

This study consists of an experience report employing quantitative and qualitative approaches. Data generation took place through an online questionnaire answered anonymously and voluntarily comprising nine closed and three open questions, as well as field notes written by the teacher. A content analysis was used for open questions and simple statistics with the Average Ranking calculated for closed questions on a Likert Scale.

The game “Anatomical Canasta” was developed by Anatomy teacher and applied in the classroom at a Higher Education Federal University in the city of Rio de Janeiro, Brazil. The evaluation of this card game involved 120 undergraduates enrolled in the second semester of the Physical Education and Sports School, during two semesters, in 2019. This research was approved by the Research Ethics Committee (CEP) under no. CAAE

18351419.8.0000.5248.

An online questionnaire answered anonymously and voluntarily, with nine closed and three open questions comprised the evaluation strategy to verify the acceptance and applicability of the developed game. The questionnaire also aimed to verify whether the pedagogical game met its educational objective, in this case, learning the content of the shoulder complex in a playful way, according to participant perspectives. The data generated from the closed questionnaire questions were analyzed alongside information from the open questions and the teacher's field notes.

The questionnaire was prepared using the Google Forms software and comprised a total of twelve questions, nine closed (one multiple choice, one dichotomous and seven on an inverted 5-point Likert scale) and three open questions. A link to the questionnaire was sent by email to 120 students, obtaining a total of 86 responses. As an inclusion criterion, only responses by students who participated in the two classes with the developed deck of cards were counted, totaling 77 questionnaires.

The questionnaire investigated whether, in the students' perception, the game "Anatomical Canasta": (a) aided in the learning of the subject in question; (b) was fun and if the students (c) identified negative and/or positive points; (d) liked the game; (e) would change the rules; (f) would play again in the future; (g) would recommend the game.

An Average Ranking (RM) was established for the results of the objective questions (answered on a Likert scale from 1 to 5), to determine the degree of agreement of the 77 subjects who answered the questionnaire. The closer the RM to 5, the greater the agreement between subjects, while the closer to 1, the greater the disagreement (OLIVEIRA, 2005).

The data obtained in the open questions were analyzed according to Fraenkel and Wallen (2008). Regarding the content analysis, all answers were read and common characteristics were identified, allowing for the creation of answer categories. Subsequently, two coders performed the analysis and discussed any differences, reaching a consensus. It is important to emphasize that the same open response can contribute to more than one category. The open questions allowed students to expose their perceptions of the game in more detail and to indicate additional considerations about the use of this tool. The open question answers were organized considering parameters that allowed for assessments on how the students perceived the teaching-learning process with the "Anatomical Canasta" game. Thus, the main ideas that resulted in categories exemplified in the results section were highlighted, based on student answers to the following question: "What are the positive and/or negative points of lessons with the developed deck of cards?" The aim was to group the data and synthesize student responses concerning the game applied to anatomy teaching.

In addition to the questionnaire, the researchers performed a reflective assessment throughout the game application process, through participant observation and field notes, seeking to identify student motivation and engagement during classes. Doubts on how to play



and on the game's content were resolved as requested by the groups. To synthesize the data, the questionnaire answers were analyzed along with the teacher's observations.

### 3 Results

#### Game design

A card game was produced with the purpose of stimulating the learning of the main joints and muscles activated during specific shoulder complex movements. The aim was to create a game in which students developed logical reasoning and not simply memorize terms.

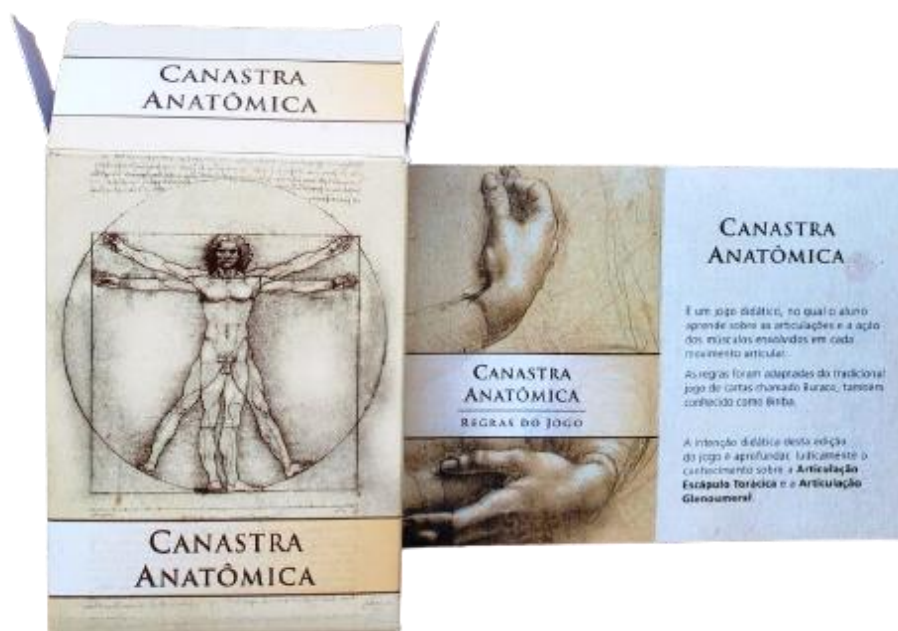
The developed didactic game is an adaptation of the traditional card game called Canasta, also known as Biriba. The game "Anatomical Canasta" has up to six participants, with four players comprising two pairs and six players, three pairs. Players must always sit in alternate positions.

The aim of this game is to try to complete as many canastas of the shoulder joint movements as possible. The scapulothoracic joint and the glenohumeral joint are presented in the game.

#### The game "Anatomical Canasta"

Each deck was designed to contain 64 cards, comprising 12 main cards, 48 muscle cards and 04 wildcards. The cards contain images and information on shoulder complex muscles and their actions. Two full decks (128 cards) are required to play. A manual with student or teacher guidance rules and a box to store and conserve the cards were also produced (Figure 1).

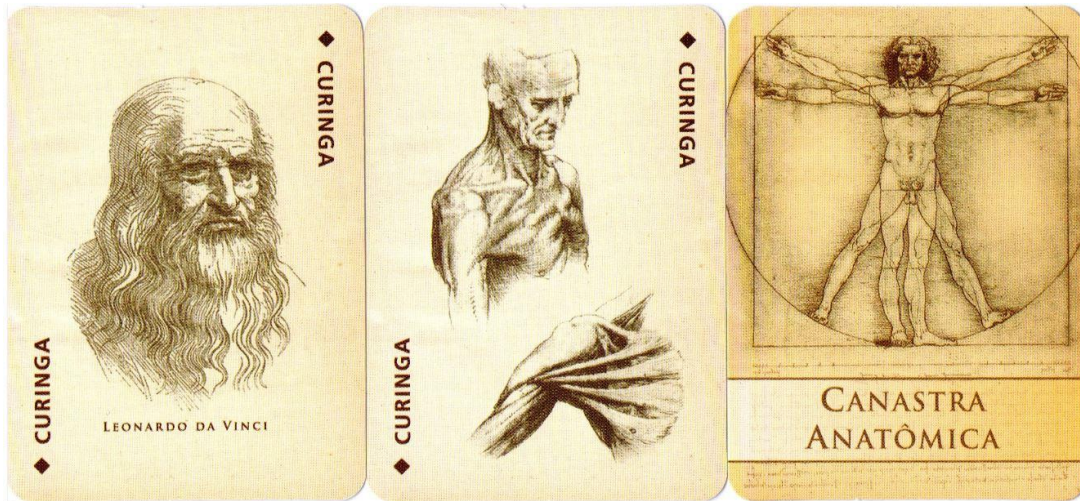
**Figure 1.** Anatomical Canasta box and Manual with game rules



Source: The authors.

Drawings of works by Leonardo Da Vinci were used on the box, in the manual, in the 04 wildcards and on the back of the cards (Figures 1 and 2), which clearly portrays human anatomy, contributing significantly to science. Da Vinci worked in different art and knowledge fields, as one of the main figures of the Renaissance and is still a reference of genius.

**Figure 2.** The wildcards and the back of the deck of the “Anatomical Canasta” game developed herein.



Source: The authors.

The playing cards were developed in brown and green, the former comprising the cards presenting scapulothoracic joint movements and muscles, and the latter, presenting glenohumeral joint movements and muscles. Of the 12 main cards, six are brown, containing the six movements of the scapulothoracic joint and highlighting the muscles involved in a specific joint action. The other six main cards are green, containing the six movements of the glenohumeral joint and highlighting the muscles involved in a specific joint action. The structure of the main chart created for the joint movement is depicted in Figure 3.

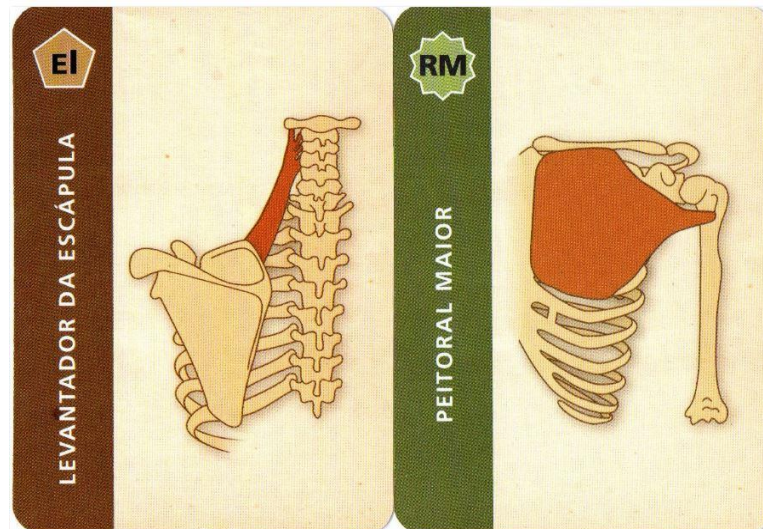
**Figure 3.** Main card - Scapulothoracic and glenohumeral joint articulations.



Source: The authors.

The 48 muscle cards each contain an illustration of one muscle responsible for one of the movements contained in the main card. This structure is depicted in Figure 4.

**Figure 4.** Muscle cards.



Source: The authors.

The game cards are divided by joint movements. Each joint movement comprises a main card (joint card) and cards with illustrations of the muscles that perform the movement described the main card. Symbols with abbreviations were created to represent joint movements. The symbols are located in the upper left corner of the cards and their colors refer to the articulation that performs them (Figures 3 and 4).

The abbreviations created for the symbols are: flexion movement (F), extension movement (E), abduction movement (Ab), adduction movement (Ad), medial rotation movement (Rm), lateral rotation movement (Rl), lifting movement (El), depression movement (Dp), upper rotation movement (Rs) and lower rotation movement (Ri).

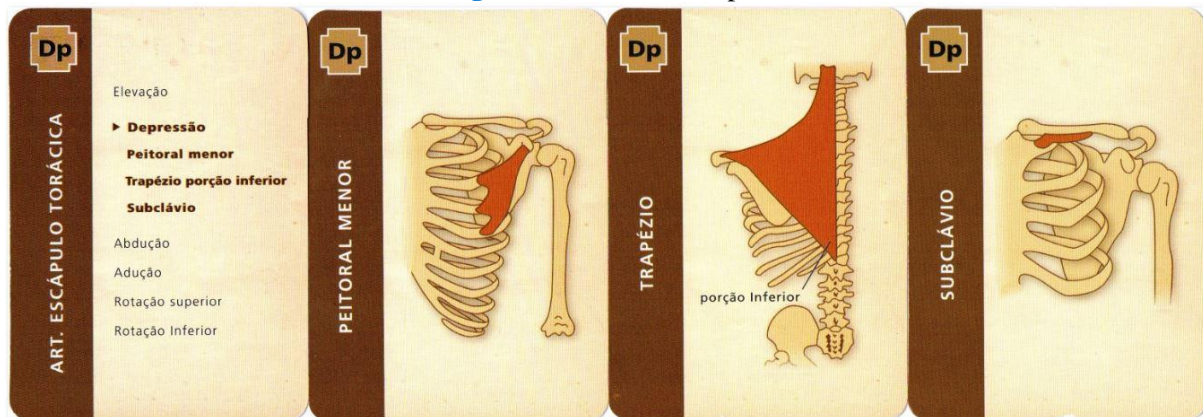
### Game dynamics

This game aims to complete as many canastas as possible. To obtain the canasta, the player must combine a main card (joint card) and all muscle cards referring to the movement of the main card. Wild cards replace any muscle card, but do not replace the main card and only be used once per game downloaded or canasta.

The canasta consists of a complete game with the main card and all the muscle cards of the same joint movement. The number of cards per canasta varies according to the joint movement, being from three to seven cards, as well as their respective score. Figure 5 displays a complete four-card canasta.



Figure 5. Canasta example.



Source: The authors.

One of the players will deal 11 cards to each player. Another will separate 22 cards forming two packs of 11 cards. Each pack is called "the dead", which must be placed face down, in the corner of the table. The rest of the cards will form part of the deck of cards that will be placed in the center of the table, face down, to be "bought" throughout the game. The cards that will be discarded during the game, called "trash", must be placed face up, in the center of the table.

On his/her turn, the player must buy a card from the pack of purchases or, if he/she prefers, may take all the cards from the trash that are on the table. Then, the player must discard a card. The game continues with each player doing the same. The player, after purchasing the card, will be able to lower his/her card combinations so that his/her pair, in his/her turn, can place other cards to the games already on the table to complete a canasta. To place a game on the table, it must be made up of at least three cards.

The player who puts all his/her cards down (hitting), must take the dead pile. If, when picking up the dead pile, he/she puts all his/her cards down without having discarded any cards, he/she will continue playing and putting cards down until discarding a card. However, if the player had to discard a card to hit, and then pick up the dead pile, he must wait another round to lower his combinations. If he/she run out of cards from the draw pile, the dead cards, one pile at a time, will be used in the draw pile. The game ends when a pair manages to hit for the second time (with the dead man's cards), or if there are no more cards to draw.

### Game applications

The game was applied in two Anatomy discipline classes for Physical Education undergraduates at a Higher Education Federal University in Rio de Janeiro, each class comprising 60 students. The classes were divided on the first day of class into teams of six, grouped by affinity, using the same logic as social networks, with the aim of encouraging a feeling of belonging, student identification with their group and bonds of affection between participants. These teams were maintained until the end of the discipline. The game was applied in two meetings.

The students' first contact with the game “Anatomical Canasta” was on the fourth day of class, right after the introduction of the arthrology theme taught in the theoretical classroom, but before the introductory theoretical explanation about the muscles of the body. The students found cards on the benches (tables) of the anatomy lab instead of anatomical pieces. The game was inserted as a surprise element in the practical class.

The teams were reorganized into ten study benches, with four or six students per bench. The activity began with a set of cards from a deck and without presenting the game rules. A 10-minute period was allocated for the team to freely handle the cards, giving the students the opportunity to get to know the deck.

Then, each team was asked to create a criterion to classify the cards, dividing the cards into categories. A 15-minute period was stipulated for this activity. Once the criterion was decided, the team would then discuss the logic created for the game and present it to the mediator, *i.e.*, one of the monitors or the teacher. This activity helps students understand the main idea of the game, making them divide the cards by colors and group the muscles by movements, preparing them to understand the rules, the pedagogical concept of the game and to answer the two game questions in the next activity.

The next activity was planned to last 10 minutes and pedagogically introduce the game. The teams were challenged to answer two questions with the help of the playing cards. The first question aimed to identify the two joints that make up the “Anatomical Canasta game” (the scapulothoracic and glenohumeral joints). The second challenge was to discover which joint actions and muscles performed the proposed movements in the game. One of the monitors or the teacher discussed the results with the team as the team solved the questions.

The next step was to hand out another deck, the game manual and ask the students to read the rules and start playing. In this block of activities, the proposal was to work on skills that make up logical reasoning and encourage students to seek alone ways to unravel the game, its pedagogical objective and the rules alone. At the end of the game, each team should describe a canasta formed during the game, informing the name of the joint, the action, the muscles involved and the movement plane and axis. This type of activity aids in fixing the analyzed content and comprised part of the report that the student should deliver at the end of the class.

The second game application was on the ninth day of class, right after the theoretical class on shoulder girdle and shoulder joint. The teams were organized on 10 benches (study table) of the anatomy laboratory (anatomical) with four or six students per bench. The team members were then asked to divide into pairs and choose a movement axis. Soon after, they were asked to pick up the cards of the muscles of the glenohumeral joint (cards in green), which act in the two movements around the chosen axis. The students worked in pairs discovering these muscles with the help of the deck cards and then presented the results to the rest of the team. Each pair performed the movements around the axis, giving a brief account of the muscles that were contracting in that joint action, and the plane and axis involved in the

movement.

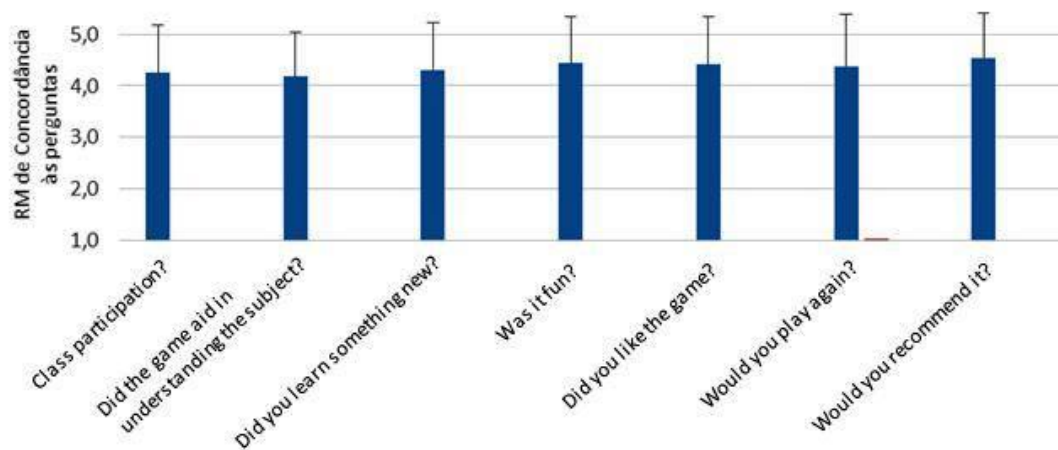
After this activity, the teams were asked to separate the cards depicting the scapulothoracic joint (cards in brown) and discover this joint's movements and the muscles that act in each movement using the deck cards. Then, bones (scapulae) were placed on the benches and each student was asked to present one of the movements to their team, using the scapulae to demonstrate. After these activities, the students played the "Anatomical Canasta" game. A time of 30 minutes was stipulated for the game.

### Game evaluation

Regarding field notes comprising participant observation and learner behavior, greater student interaction, engagement, and participation in classes with the use of the game were evident. The notes are related to game activity periods, and these observations served as a basis for the analysis of the open and closed questionnaire questions.

The RM values for the answers to the questionnaires are depicted in Graph 1. The RM values attributed to the answers to this questionnaire pointed to a value above 4 for all answers to the objective questions on a Likert scale, thus presenting a high degree of agreement. This indicated a general positive evaluation of the "Anatomical Canasta" game from the students' point of view.

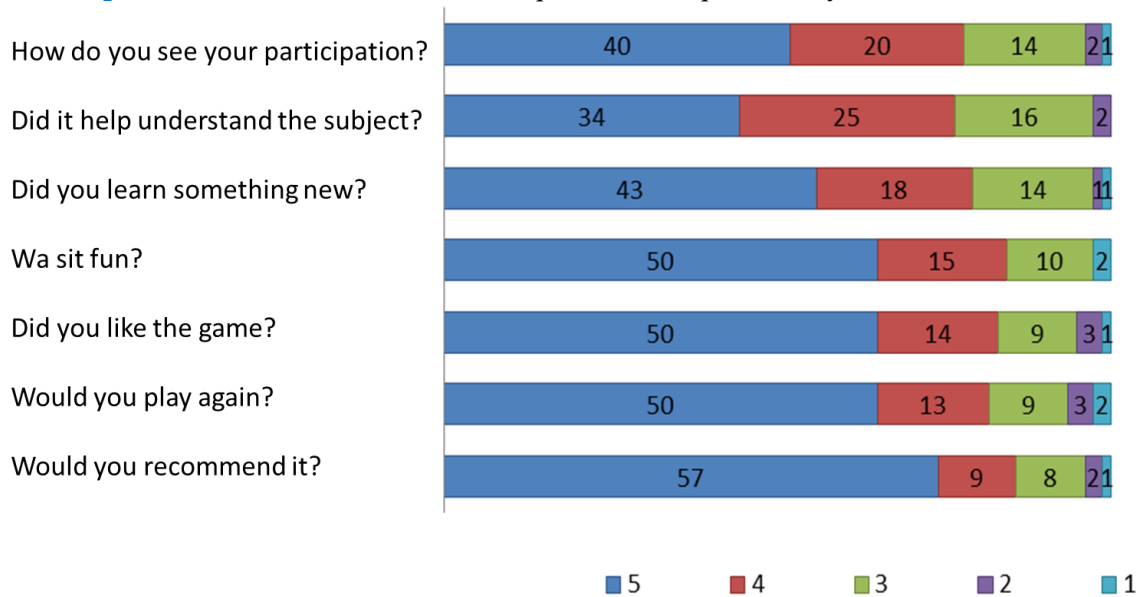
**Graph 1.** RM agreement values for the Likert scale questions.



Source: The authors.

Graph 2 presents the questions with multiple answers on a Likert-type scale, ranging from 5 to 1, with 5 indicating full agreement and 1, total disagreement.

**Graph 2.** Distribution of answers to the questionnaire questions by number of students.



Source: The authors.

When asked about participation in the deck of cards lessons, an RM=4.2 was observed (Graph 1), indicating good student participation in these lessons. Forty students marked the option “excellent” and twenty, the option “very good” concerning participation in the game classes (n=77) (Graph 2). Student participation may be due to the fact that they felt motivated by the game, as reported in other literature cases employing games (COSTA; MIRANDA; GONZAGA, 2018; FRAGELLI, 2018; SILVA; MELO, 2019).

Motz et al. (2019) highlight the use of games in anatomy and physiology teaching and agree that they assist in learning the classroom-taught content and can comprise an effective tool to reach students with different learning styles. In this context, students displayed high agreement in indicating that the game helped them understand the subject (RM=4.1) (Graph 1), with 59 students (77%) responding with 4 or 5 (Graph 2). Authors, in general, understand that games are an important tool for anatomy teaching and learning (HILL; NASSRALLAH, 2018; SANTOS et al., 2019; SILVA; MELO, 2019).

The perception that students learned with the deck of cards was very expressive (RM=4.3) (Graph 1). Most students (80% scored above 4) stated that they learned something new with the game (Graph 2).

The fact that the game was introduced as a surprise element provoked positive reactions. The students were surprised when they arrived at the anatomy lab and found cards on the benches, instead of anatomical pieces. During the class, their enthusiasm for learning the subject in a light, relaxed and pleasant way was visible. Most liked the game (RM=4.4) and had the feeling that learning with the game was fun (RM=4.4) (Graph 1). Their answers were evident in indicating that they were learning in a pleasant way. These results that games aid in learning content in a playful and fun manner have also been reported by other authors, such as Ribeiro, Bonini and Mello (2019) and in Santos et al. (2019).



When asked about the possibility of playing again another time, 64 students (82% assigned values above 4) declared that they would play indeed again in the future (RM=4.3) (Graph 2).

When asked if they would recommend the game “Anatomical Canasta” to colleagues who attend classes with other teachers, 66 students responded positively (attributing values above 4, comprising 86% of the students) (Graph 2), with an RM value of 4.5, indicating a high degree of response agreement (Graph 1).

Interesting results emerged in the open question answers concerning what students learnt from the game. A total of 74 students (96%) considered that they learned with the game and only three (4%) questioned the learning. Regarding content, the following statements highlight how the cards made it easier to understand muscle position, joint shoulder complex movements and agonist and antagonist muscle movements:

- I learned to better visualize the actions that muscles perform, because you can better understand the notion of how the muscle acts by looking at the muscle separately and imagining the movement. (A3)
- The deck allows for a search. In addition to informing what joint is involved, it indicates the action and muscle involved in the movements. (A7)
- I was able to better visualize the movements that some joints make and the main muscles that perform these movements. It also helped me to understand more about agonist and antagonist muscles. (A17)
- As the game was presented before the scapulothoracic and glenohumeral joint classes, I learned a lot from the game, as it helped me understand the subject and identify which muscles are located in each joint in harmony with the movement. (A49)

The deck also aided in memorizing muscle names:

- I learnt the names of the muscles that appear in the deck. (A57)
- I was able to better remember the muscles while paying attention to the cards during the game. (A72)

The other highlighted factor was the importance of learning in a playful/fun manner:

- I learned more details about joints, muscles, and their movements in a more playful manner, as I had the cards with images that made it much easier to identify a particular muscle, for example. (A8)
- I learned things about the subject that I didn't know in a fun way. (A16)

One of the answers reflects beyond only learning the subject and exposes the importance of playful experiences in teacher training, as discussed by Fortuna (2019), who reaffirms that games teach, but not only in the sense of knowledge acquired by playing, but also in a broader sense, tracing education to think from a playful perspective and revolutionize learning and teaching:

-I learned that creative and differentiated ways are always a good way to understand a certain content, and that I can use similar methods with my students in the future. (A28)

Tânia Fortuna (2019) states that teachers may learn more from playing than the students themselves, as teachers end up finding a new paradigm in the game, even for life, which she terms ludic pedagogy. The positive experience of learning through games seems to encourage licentiates (future teachers) to repeat the same actions of their teachers in their professional life. Teacher knowledge is an experiential knowledge and based on teacher knowledge linked to their experience and the experience of certain teachers, according to Tardif (2000). It is necessary for teachers to diversify teaching ways to graduates. In this regard, creating active methodologies to approach the subject in a pleasant manner, leading students to participate and interact with the group, can comprise a good strategy to stimulate and maintain student interest in learning and becoming a better teacher.

Of the 77 students who answered the questionnaire, three (4%) considered that they did not learn the subject adequately with the cards. Although Anatomical Canasta was based on a popular game, one student felt harmed by the fact that he did not know how to play cards and the other two did not recognize learning through the game. These speeches are depicted below:

- I learned little. I don't know how to play cards and that interfered. (A63)
- I didn't learn much. (A53)
- I was still in the process of learning. (A77)

Concerning the positive points of the card lessons, the students highlighted the following: (1) the game as a **learning tool**; (2) the different **dynamics** that stimulate students; (3) the **fun** the game promotes; (4) the **layout** of the cards that aid in content visualization and, consequently, in the learning process; (5) the group **interaction** provided by the game; (6) the relevance of **competition**. Agreement with the answers described above are noted when comparing the answers to the question concerning the positive points of the game in relation to what students learnt from the game. Table 1 depicts some student speeches according to the categories listed above and the frequency in which they appeared.

**Table 1.** Positive points of the card lessons.

Category	Frequency	Representative transcript
(1) Learning tool	56% (43 students)	The deck <b>helps a lot</b> to really understand all the muscles directly involved, removing doubts (A13).  The different way of looking at the story, the content is a lot, but in this case, embedded in a game, it becomes <b>easier to understand</b> (A36).
(2) Dynamics	36% (28 students)	<b>Different</b> and attractive dynamics, which attract students to the class and make them want to participate (A5).  <b>A different and innovative way</b> to learn and "record" subjects considered difficult to remember (A70).

(3) Fun	33% (25 students)	The group is entertained by the activity and ends up learning the subject while <b>having fun</b> (A11). Easier to understand and visualize. <b>Learning by playing</b> is much more efficient (A46). .
(4) Layout	14% (11 students)	The most positive point for me was to look at the muscle separately through the <b>drawing on the cart</b> and analyze it together with the movement that the letter says it did (A3). It helps to <b>visualize the active muscles much better</b> and offers an objective summary of the subject (A24). .
(5) Interaction	7% (5 students)	Different dynamics encourage reading and <b>socializing with the group</b> (A21). <b>Good interaction</b> , fun classes and a good way to learn and play at the same time (A35).
(6) Competition	3% (2 students)	Learning by playing cards, learning <b>competitively</b> , learning in a fun way (A4). It's a very easy way, it's easy to learn playfully, creating debates and even <b>competitiveness</b> on how to learn more, it makes us think which muscles are missing for us and the partner (A14).

Source: The authors.

The answers to the question about the negative points of the game were categorized into: (1) **Not knowing how to play** canasta; (2) **Dispersion** in relation to the aim of the activity; (3) Playing for a **short time**; (4) Playing for a **long time**. Table 2 presents the main transcripts of student responses. The grouping into these four categories allowed us to arrive at some results.

**Table 2.** Negative points of the card lessons.

Category	Frequency	Representative transcript
(1) Not knowing how to play	23% (18 students)	I think we should have a better introduction to the game since many have <b>no idea how to play canasta</b> and I also think that classes with the game could happen more often (A28). The only negative point is when students <b>do not know how to play</b> and this makes them waste more time with the rules than the canasta itself and as there are few classes, these students cannot acquire the richness of the anatomical canasta (A64).
(2) Dispersion	8% (6 students)	I think a negative point is that many people, because the information is already there, easy to obtain, end up <b>not exploring</b> a possibility of information and observations that can be obtained through canasta (A3).

		Student <b>dispersion</b> concerning the final objective of the game (A4).
(3) Short time	8% (6 students)	I needed <b>more</b> classes (A48). If you have <b>little time</b> to play, it is difficult to learn by playing (A69).
(4) Too long	3% (2 students)	<b>Excessive</b> time with the game (A22). As the <b>game is long</b> , it becomes boring (A47).

Source: The authors

Regarding the negative points of the game, when analyzing the category “Not knowing how to play canasta”, 18 students (23%) considered that they were harmed in learning the class content, due to the lack of knowledge about the rules of the traditional “canasta” game. However, when asked if they would change any rules of the game, most students (74, 96%) answered no and only three (4%) would change the rules. These students suggested the following changes:

- Whoever finishes the cards first wins the game without having to count the points. (A47)
- Being able to play two cards in the same round to end the game. (A52)  
Play without the wildcards. (A55)

The negative results pointed out by the students concerning understanding the rules of the game, are probably due to the methodology applied to solve the activities. The proposal to work on skills that make up logical reasoning and encourage student to seek ways alone to discover: (1) the coherence of the game; (2) its pedagogical objective and (3) the rules, made the activity more complex. At no time did the teacher and the monitors explain the rules, they only gave tips on how to reach the final goal. Understanding the rules is part of the class. However, many students intuitively played canasta without reading the rules, playing with the help of a colleague who already knew the rules. In fact, it was evident that some students did not read the rules. This lack of understanding of the rules may have led to the dispersion of eight students, comprising 6% of the respondents.

It is essential that the criteria for solving the tasks proposed in the classroom be clear and that the main aim of the activity is the teaching-learning process. Playing and winning are consequences, not the goal. After the students go through the entire process to unravel the game, a student's suggestion to explain canasta rules can certainly comprise a solution so that students who did not know the game may be included.

The short game time was another item considered by six students (8%) as negative. During the card lessons, the students expressed that they would like to spend more time playing, because they were learning in a pleasant way and would like more lessons with the deck. On the other hand, two students (3%) complained that they spent too much time playing.

The answers that did not fit into any category were identified as “non-categorized answers”. Of the six responses in this category, one student gave a very interesting report when addressing the fact that the subject was better learnt through game content questions,



which were answered by consulting the cards, and that the interaction of the two activities (questions and game) helped in learning the subject. Another student understood the game as a reinforcement of the subject. One of the students commented that the game should be commercialized and another highlighted that it would be interesting for the game to present other body joints. One student commented on finding the game boring and another complained of having to put the cards in the box after the game.

According to the teacher's field diary, the students photographed the letters to study at home, asked about where to buy the game and were disappointed to learn that it was not sold. The fact of wanting to buy the game may be an indication that the students liked the game as a different way of learning Anatomy content.

The findings demonstrate that the game “Anatomical Canastra” can be a motivating and promising strategy for learning anatomy, although it is important to diversify the proposed activities to include all students in the teaching-learning process.

#### 4 Final Considerations

The main objective of this study was to report the experience of developing a game to aid in anatomy teaching in a playful manner. To this end, the game "Anatomical Canasta" was developed, which can be used individually (employing the rules of the traditional "Solitary") or in a group, with or without teacher tutoring, serving as basis for a class on the proposed theme depicted in the cards.

It is clear that this game may comprise an important resource in the higher education anatomy teaching-learning process in. The use of the game “Anatomical Canasta” led to better learning of the subject from the students' point of view in a fun way, with participant engagement and interaction.

Traditional teaching has been adapted to a new reality, leaving the previous stagnation stage and being reinvented to attract a new generation of university students. The use of active methodologies like classroom games makes teaching more dynamic and interesting, serving this new audience.

The game will be made available as an Open Educational Resource (OER) on an educational platform for printing on A4 paper on a home printer, allowing students and teachers to make their own game. We also intend to create a version II of the game, which will consist of sets of cards with images and information on lower limb muscles and their actions. Furthermore, the possibility of making both versions available in digital format is being studied, so they can be played on computers, smartphones or tablets.

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