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Radiarte: A New Didactic Tool for Teaching Radiology. A Qualitative Study of the Sensory Perceptions of Students

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Materials and methods: A qualitative ethnographic study was carried out with cumulative sampling. The data collection was done through field work and focus groups, achieving a triangulation of the students' perceptions of the research.

Results: The perception of the medical students about the didactic tool shows a positive effect on the significant learning being more practical the learning with the correlation by drawing in an established learning environment. The evaluation system proposed allows students to know the transmission of ideas.

Conclusions: The RADIARTE tool is an innovative didactic tool that allows the development of practical and useful skills in the medical student for the performance of medicine in primary care.

MeSh: *radiology, problem based learning, perception, advance medical planing.*

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I. Introduction

The adequate performance of the primary care physician is paramount in the care of patients nowadays in the Colombian health system. One of the most important problems is the development of skills in the work team and the transmission of ideas to patients; therefore, it should be a priority to work on these competences in undergraduate medicine.

One of the areas with the most problems in primary health care is Radiology, where the proper use of resources for making decisions with diagnostic images becomes crucial. Because of this, it is of vital importance that the primary care physician learn to optimize health resources by requesting and interpreting the most important diagnostic images in their area of work. Therefore, in Bogotá, Colombia, a didactic tool based on the schematic drawing for learning in the area of Radiology called RADIARTE has been created by the researcher. This tool is developed in an elective matter that seeks to correlate the imaging findings of the most prevalent diseases to which the primary care physician will be confronted using conceptual associations with drawings created by the students in the development of the subject. The evaluation method used is through equipment and evaluation of the transmission of ideas in an appropriate learning environment an art exhibition where students from other careers, teaching specialists and radiologists assess the information transmitted through the use of drawing. With this tool, they develop skills in meaningful learning, teamwork, and evaluation of the transmission of ideas in an appropriate learning environment (Figure 1-4).

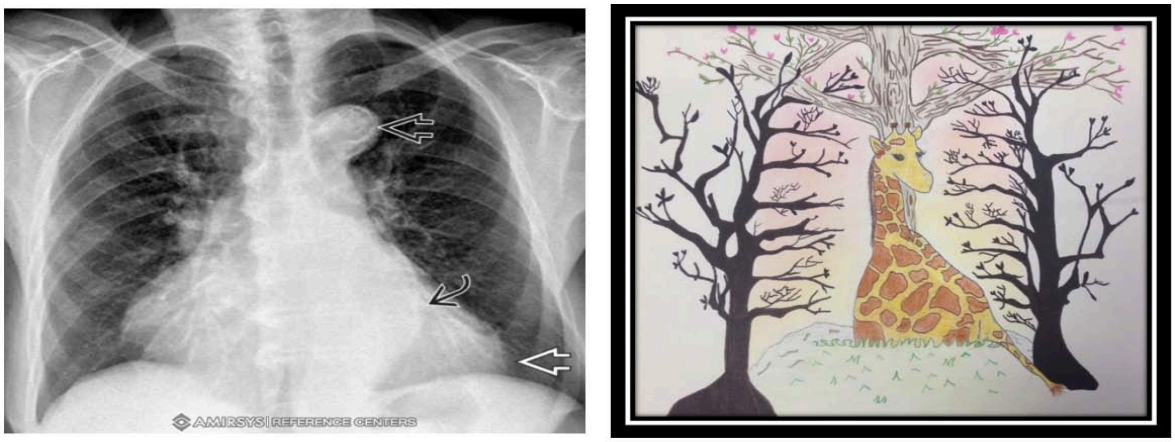


Figure 1: Chest x-ray

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Chest x-ray in AP (anteroposterior) view with severe aortic stenosis and cardiac dilation. A radiopaque image is observed in the apex cardiac caused by concentric ventricular hypertrophy (white arrow), and a tortuosity in the aorta with the presence of calcification (black arrows). In the drawing, the prominence of the aortic arch with the head of the giraffe is interpreted, while its body interprets the hypertrophy of the left ventricle. Likewise, the bony structures are interpreted with the branches of the trees. Image is taken from Amirsys by university platform.

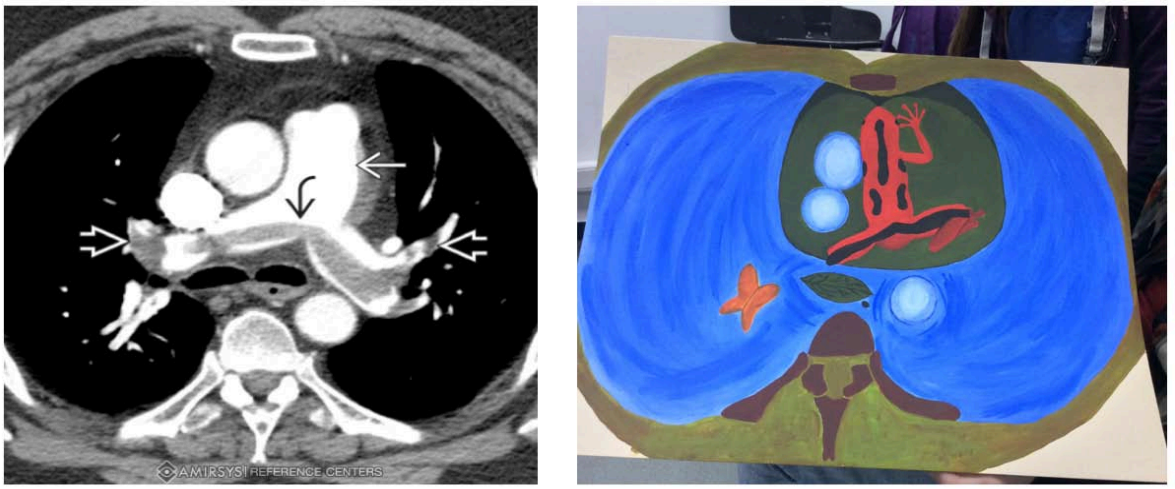


Figure 2: Thorax tomography

Axial reconstruction showing the presence of a thrombus (black arrow) in the pulmonary trunk extending to the pulmonary arteries. Additionally, the presence of a lobar thrombus (white arrow) with the presence of pulmonary hypertension is shown. In the drawing, the trunk of the pulmonary artery is interpreted as the body of a frog, which rests on a leaf that interprets the cardiac silhouette. The pathological finding of the thrombus within the artery is represented by the skin colors of the frog. Image is taken from Amirsys by university platform.



Figure 3: Magnetic knee resonance

Magnetic resonance of the knee in coronal section with the presence of multiseptated para meniscal cysts with medial horizontal meniscal lesions. In the drawing, the femoral condyle is interpreted through the eyes of the owl. Likewise, the cruciate ligaments are interpreted by the owl's beak and the tibia using the neck of the owl. Image is taken from Amirsys by university platform.

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Figure 4: Learning environment

A learning environment where students work in groups to solve learning problems in the development of drawings that correlate with pathological images.

The systematic review of the literature by the researcher shows the evidence of this didactic tool in related areas such as anatomy with positive quantitative results. However, in the area of Radiology, it has not been demonstrated that there are sensorial perceptions that students have with this tool for meaningful learning. For this reason, the present study focused on determining the sensory perceptions of the tenth-semester medical students of the faculty of health sciences at the Rosario Unevirsity with the Radiarte teaching tool (Radiología desde el arte) in the area of radiology. Through qualitative research with an ethnographic approach.

This research model allowed the researcher through ethnography to clarify the sensory perceptions of students in the learning sessions. Subsequently, a focus group session was held to collect data from the research actors. This design allowed to achieve triangulation of the inductive, deductive categories and the theoretical referents to build the conclusions proposed at the end of the project and obtain some recommendations for the improvement of significant learning in the medical students of the Rosario University.

II. Materials and Methods

For the collection of the existing information the state of the art was made with the search of the bibliography in international databases such as Medline, base, Ovid with search engines established by MeSH terms. This raised the questioning and problematization of what is known about this didactic tool in the general literature and learning in the areas of health. For this, the delimitation of the object of study for the use of the tool in medical students in the radiology area was carried out. With this, it was allowed to enter into the design of the elective class and to be able to pose how the research and field work would be developed to methodologically design the research study in the best way. With all this process it was found that the key informants for this study were the 10th-semester students of medicine who were previously exposed to a previous teaching tool in this area. Likewise, they had a more established income profile to be able to effectively develop the study of the variables.

The choice of the proposed methodology and the qualitative method was the ideal to establish the sensory perceptions of the students. The design chosen for this study was intentional and reasoned, where the sampling units were chosen by the discourse of the study where it was intended to obtain the information of the entire accessible population; therefore, the cumulative sampling of 45 students during 18 months was considered.

The development of the field work was carried out by the researcher, who got involved in the classroom with the students interacting with each group about their opinions of the tool used, developing little by little the field diary with the attitudes, expressions, verbal and non-verbal behavior of students, in order to continue building the reformulation of research within emerging design. In this period, the researcher analyzed the learning environment where the didactic tool was developed, completing the information with the opinion of the actors of the research. For the evaluation of the

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work of art, the researcher was present in the qualification of the works by the evaluators taking the verbal opinions and the expressions of the behavior at the time of the evaluation. For the collection of the data, the focused group session was obtained where the data was obtained with voice recording. In addition, the details of the non-verbal language of the interviewees were taken into account, which allowed obtaining additional information from the discussion.

The technique of data collection was carried out by the researcher using the ethnographic method described above, and subsequently two focus group sessions were carried out with random assignment for each semester. The data collection was done through audio recording in the focus group sessions established by the researcher. Subsequently, the transcription of the data was obtained with the help of the naturally speaking program "dragon" and it was exported to Word office 2010. For the analysis of the information was made in the Atlas. Ti program, completed with the use of images established by the researcher in the field work. Finally, the inductive categories that emerged from the voices of the actors were obtained (figure 5).

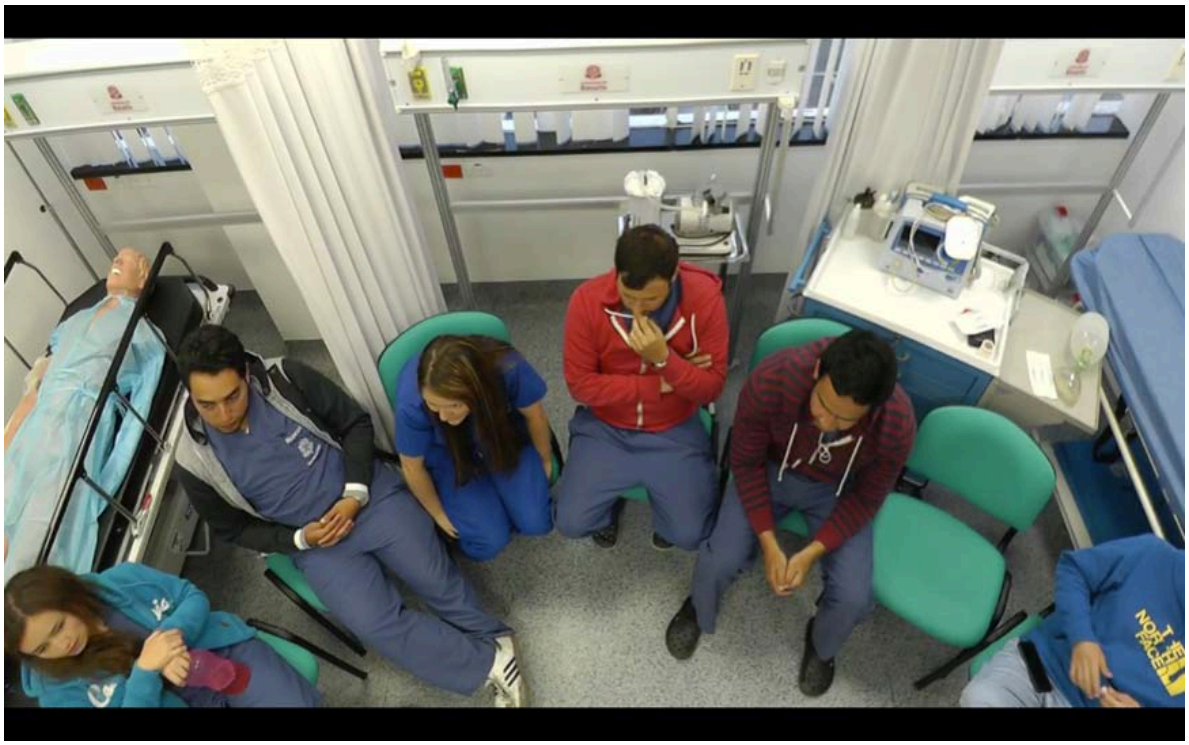


Figure 5: Photograph of students of the focal group located in a manner assigned by the researcher to obtain data collection

III. Results

All students (45) signed informed consent to participate in the research, where six focus groups of one hour duration were conducted, involving students of both sexes with a random assignment for each focus group. 96% of students belonged to the fifth year of medicine between 18 and 25 years old. The information collected for the triangulation was from the focus groups, field work, and theoretical references.

a) Sensory Perceptions

Students consider that it is more practical to learn with this didactic tool since having the option to draw to correlate allows to generate clearer concepts and long-term memory, "... This tool is more practical, we are seeing the image that you give us and one looks for the drawing, it seems to me that one is not going to forget one ... ". Likewise, this tool can generate a better association of the radiological findings of diagnostic images with instruments or figures of daily life. On the other hand, it seems to them that the way of interpreting the pathologies and the anatomical repairs in the images is better, since it allows them to generate a better learning link based on the analysis and the search of images that correlate with the described findings " ... it allows us to let the imagination fly so we can find the correlation; For example, our group in the last work took a long time to choose the image, but one realizes that you can always find an image that correlates with the most characteristic patterns of the image ... ".

The opportunity for this subject to cover more thematic content allows students to grow in their knowledge and correlate more pathologies seen in previous semesters in different specialties "... In this elective we have seen the complete modules with the difference of normal and abnormal, here we have had a

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little more knowledge, this is more creative, and you can stay one in mind ... ".

b) *Evaluation: objective qualification, Self-evaluation, co-evaluation, hetero-evaluation, Transmission of ideas*

The students express that the proposed evaluation process allows them to establish that the objectivity leads to the co-evaluation by pairs of students who do not have experience in the subject and for which it does not influence if the student has other weaknesses and abilities in the hidden curriculum, since the fact of evaluating a result allows to evaluate all the effort in a single work "... an external person or knowledge expert is a pair that sees the same thing and contributes to the result they are doing, or in other methods a personal or professional pair ; Likewise, a third evaluator with many years of experience in teaching is able to see things from various points of view and who can evaluate things as medical auditors do ... ". This allows them to extrapolate the results with what they are going to see as health professionals in a primary care setting where they should imply to the families the results of a medical care process and they who are not experts in the subject. They will have to qualify their work from a totally objective point of view without prejudice to the other characteristics of the doctor.

Students express the importance of transmitting ideas to patients in the professional field so that the fact of being able to express characteristics of the images in a drawing allows the evaluator to establish if what the author means is what expressed on paper "... It is a tool to be understood. Not only make yourself understood with the patient, but any person who comes forward. You must have many tools to be able to show what the patient has and also to your colleagues; also, show everything in the drawing because we are not going to be in the exhibition, which is why we have to show everything in the best possible way and this can be helped when we are later in a conference as speakers or with patients in the office ... ".

IV. Discussion

The society of the 21st century is focused on knowledge and learning throughout life; their individuals learn permanently, understand what they learn, select the appropriate for each context and adapt and transform in front of new situations (1). This reality supposes a major challenge in the university formation, it implies the substitution of a traditional transmissionist pedagogical model, for a model centered on the student, that is integrating and constructive, that possesses learning and teaching strategies that favor the achievement of meaningful learning.

Medical education does not move away from the profound changes in university education, and although historically the pedagogical model in the education of health sciences has been the traditional positivist, passive and content-centered model, in recent decades they have been implemented active teaching and learning methodologies (2); Therefore, a turn towards a constructivist pedagogical model has been initiated, centered on the student, on the development of competences and learning.

Thus, in the decade of the sixties, a group of teaching physicians from McMaster University (Canada) recognized that it was necessary to modify the teaching of medicine, positivist, by the method of Problem Based Learning (PBL). Of constructivist cut; because the disproportionate production of scientific knowledge and technological advances, demands a permanent change every day in the competencies of the health professional (2). There are many studies showing the great effectiveness of PBL in learning in health sciences (3).

Despite the great demonstrated global advantages of the ABP, it has been found that it has problems in the development of the working groups; for example, that learning is group and is not individual, if the group is conflictive does not allow to develop skills well and if the tutor in charge does not have enough skill for group management does not allow the development of skills (4). A cross-sectional study published in the Journal of Ayub Medical College, compared 100 third-year students of the University of Islamabad, finding statistically significant evidence (value of $p < 0.05$) that the most frequent problems of PBL are lack of commitment to students for the preparation of the topic and the clash of personalities within the group (4).

In addition to what the scientific evidence shows, currently in the first years of the medical career, especially in the basic sciences, many contents are still transmitted through lectures, since unlike the clinical areas (where the opportunity to acquire knowledge through practices with real clinical cases, which offers an active pedagogical perspective), in the basic areas the contents are often strictly theoretical and require orientation, structuring and organization of the teacher through the master classes (5). Likewise, the volume of university students growing (from 75 to 100 students per classroom), leads to the master class continues to be widely used, since it is cheaper, it is flexible, it consumes fewer hours of teaching work, it can be cover more topics and it is possible to instruct many more students at the same time (6).

Due to the drawbacks of the new learning models, some tools have emerged to improve learning in the health sciences. In anatomy, for example, a tool based on anatomical drawing has been designed for understanding concepts (7). This tool has shown good results in the learning of the anatomy subject; the students express to understand the concepts better with the anatomical drawing; however, introducing this method within the academic program is very difficult

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since it needs a great amount of time to be able to develop the learning workshops.

Designing teaching tools for learning in medicine is a real challenge. As the scientific evidence supports, the barriers that exist have been raised, despite being a field widely studied for meaningful learning. Likewise, the didactic tools based on drawing learning are very limited and for this reason there is no perception or impact of these tools on medical students.

The RADIARTE tool is a new tool with few bibliographic antecedents of its use in the area of Radiology, for which there is no approach of the perceptions of the students with this new didactic tool. With this investigation it was possible to determine that the didactic design of the tool allows obtaining a better clinical correlation in the association of diagnostic images with schematic images according to what the students describe concerning to their previous experience with other radiology subjects. Likewise, having theoretical contents in addition to the pathology of thorax allows expanding the significant knowledge on the part of students to face other areas of knowledge that require basic training for decision making.

The didactic tool RADIARTE is established as an excellent didactic tool to complement the radiology area in medical students, since it allows complementing previous concepts acquired with a traditional method.

The learning environment used with the RADIARTE tool is established as the ideal scenario to develop meaningful learning by teamwork, as it allows team communication to develop and to know the opinions of group members for decision making and to be able to solve a certain problem. On the other hand, the approach by the teacher and their role in this learning environment allows an optimal student teacher relationship for the resolution of doubts and the comfortable development of meaningful learning.

The form of evaluation of the RADIARTE tool allows developing elements of objective evaluation. The proposed evaluation model allows knowing the perception of an academic pair, a person with knowledge in teaching and a pair without previous knowledge. The co-evaluation model seeks the development of skills for the transmission of ideas, which can be extrapolated to the professional's management with the patient and family members.

V. Conclusions

This research allows us to determine what is more practical to learn with this didactic tool according to the perceptions of the students, since having the option of drawing to correlate allows to generate clearer concepts and long-term memory. Likewise, this innovative tool can better develop mental processes, as it allows improving sensory and cognitive connections for meaningful learning. Working in a group allows to nourish the decisions from the experiences and concepts of each one of the members for the decision making; as well as the coevaluation model allows an objective evaluation and seeks the development of skills for transmitting ideas, which can be extrapolated to the management of the primary care professional with the patient and their relatives.

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Execution: Medical students of the elective Radiology from the art of the University of Rosario academic periods 2015-2, 2016-1, 2016-2.

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