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From the Blackboard to the Museum: Experiences with a Mixed Methodology in the Teaching of Anatomy for Nutrition Students

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Abstract: The teaching of Anatomy in Health Sciences programs presents significant didactic challenges due to its conceptual complexity and the need for clinical integration. This study assessed the impact of a mixed methodology applied to Nutrition students, combining lectures, model creation, visual resources, clinical case discussions, and guided visits. A structured questionnaire, based on validated instruments, was administered to 48 students at the end of the course. Quantitative results showed high levels of acceptance (all means > 4.5), with multiple-choice assessments (M = 4.98), coloring worksheets (M = 4.60), and anatomical models (M = 4.58) receiving the highest ratings. A total of 87.5% of participants expressed interest in repeating the methodology. Qualitative analysis identified five recurring themes: visual learning, practical contextualization, clinical integration, academic autonomy, and the role of the teacher as a facilitator. The findings support the value of active and multisensory strategies in anatomical education, promoting a more meaningful and engaging learning experience.

Keywords: Mixed methodology, Anatomy, Medical education, Active learning, Student perception.

Introduction

Human Anatomy is one of the foundational subjects in health education programs, essential for understanding physiological, clinical, and therapeutic processes. However, its teaching is often subject to criticism due to the heavy content load, excessive memorization, and lack of connection to professional practice.

Several studies have highlighted that the use of active methodologies— such as didactic models, visits to anatomical museums, clinical case analysis, and audiovisual production— can enhance meaningful learning, motivation, and students' perception of the relevance of the content (González et al., 2021; Silva & Rocha, 2020). In this context, the present study aims to document a pedagogical experience implemented with a cohort of undergraduate Nutrition students, based on a mixed teaching approach, and to reflect on its effects on students' perceptions.

Objectives

General objective

To evaluate the impact of a mixed methodology on students' learning perception in the Human Anatomy course for Nutrition students.

Specific objectives

- To analyze students' perception of the usefulness of the different teaching strategies employed.
- To identify the most highly rated activities in terms of their contribution to the understanding of Anatomy.
- To describe qualitative comments that offer suggestions for improvement or reflections regarding content overload.

Methodology

An observational, cross-sectional study with a mixed-methods approach (quantitative-descriptive and qualitative) was designed. The study was conducted at Rafael Landívar University (Guatemala City campus) with second-year students enrolled in the Nutrition program who took the Human Anatomy course during the first semester of 2025. The final sample consisted of 48 participants.

A structured questionnaire was used, which included:

- Perceptions of the strategies used (Likert-type scale adapted from the Student Evaluation of Educational Quality [SEEQ] and the Anatomy Learning Environment Questionnaire [ALEQ]);
- Additional items on perceived workload, motivation, and relevance to the degree;
- A qualitative section with open-ended questions (reflections on the experience and suggestions).

The data were analyzed using descriptive statistics through measures of central tendency with Microsoft Excel 360. In addition, a thematic qualitative analysis was conducted based on the open-ended responses.

During the writing phase, the artificial intelligence tool ChatGPT (OpenAI, GPT-4 version, 2025) was used to support the initial structuring of the manuscript, linguistic revision, and wording suggestions. All contents were subsequently reviewed, corrected, and approved by the author. AI was not used to generate data, interpret results, or replace the author's academic reasoning.

Results

A total of 48 second-year Nutrition students participated in the survey. Among them, 83.3% were women and 14.6% were men. Most students were under the age of 20 (54.2%), while 39.6% were between 20 and 22 years old, and 6.3% were 23 years or older. One-quarter of the sample (25%) had previously taken an Anatomy course.

Quantitative Data

Tab. 1. Mean Scores on the Perception of Didactic Strategies in the Human Anatomy Course

Survey Items	Mean	95% CI
Lectures with drawings on the board helped me understand the topic.	4.71	(4.54-4.87)
The visit to the Anatomy museum helped contextualize theoretical knowledge.	4.57	(4.33-4.81)
Creating anatomical models with modeling clay improved my learning.	4.58	(4.41-4.75)
Coloring worksheets reinforced my knowledge of anatomical structures.	4.60	(4.41-4.79)
Producing a video helped me study and better understand the content.	4.48	(4.25-4.71)
Discussing clinical cases allowed me to apply what I learned to real-life situations.	4.56	(4.37-4.75)
Multiple-choice and case-based assessments were appropriate to measure my learning.	4.98	(4.94-5.0)
The course increased my interest in Anatomy.	4.79	(4.66-4.92)
The instructor demonstrated mastery of the subject and was willing to address questions.	5	(5.0-5.0)
The mixed methodology was suitable for learning a complex subject like Anatomy.	4.96	(4.90-5.0)
I felt the course covered too much content in a short period of time.	4	(3.67-4.33)
Creative activities made the learning process more dynamic.	4.79	(4.66-4.92)

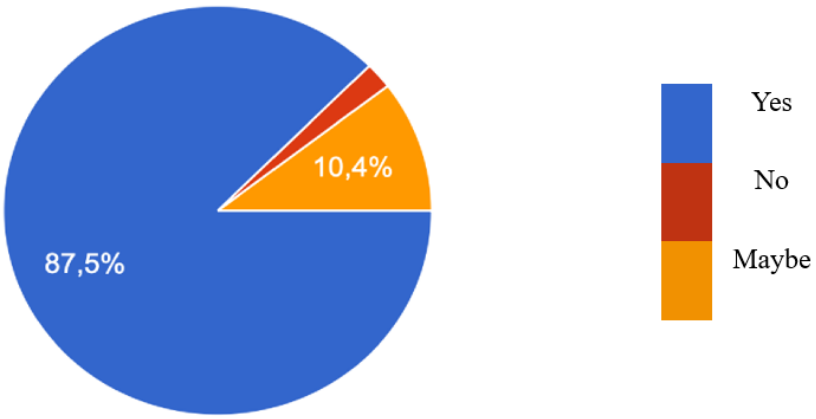
Note. Data collected from second-year Nutrition students (n = 48). Course offered during the first semester of 2025 at Rafael Landívar University. Ratings based on a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

Tab. 2. Mean Scores on the Applicability and Motivation in the Human Anatomy Course

Survey Items	Mean	95% CI
I believe that what I learned in this course will be useful for my training as a nutritionist.	4.77	(4.63-4.90)
I felt motivated to study this subject.	4.52	(4.38-4.65)

Note. Data collected from second-year Nutrition students (n = 48). Course offered during the first semester of 2025 at Rafael Landívar University. Ratings based on a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

Figure 1. Student Support for the Application of the Mixed Methodology in Other Courses



Note. Data collected from second-year Nutrition students (n=48) at Rafael Landívar University during the first semester of 2025.

Qualitative Data

Tab.3. Main themes from the qualitative analysis of the question "In your opinion, which activity was the most useful for your learning, and why?"

Theme	Description	Example	Mentions
Visual and spatial learning	Use of anatomical models and coloring worksheets.	"The coloring sheets helped because assigning a color to each part made it easier to identify and store in my memory."	21
Experiential learning	Out-of-classroom activities such as museum visits and virtual anatomy labs.	"The museum activity really helped my learning because I could relate what we saw in class to what I saw in person."	11
Case-based learning	Application of anatomical knowledge to hypothetical clinical cases.	"Solving clinical cases helps us develop critical thinking and professional skills."	4
Learning through content creation	Creation of educational resources (videos, study guides).	"Making the video was useful because the student had to research and draw conclusions in order to present it."	4
Other	General mentions of all activities and asynchronous classes.	"Honestly, all the activities we did helped me learn."	8

Note. Themes were identified through thematic analysis of open-ended responses from second-year Nutrition students at Rafael Landívar University (n = 48).

Tab.4. Main themes from the qualitative analysis of the question "What would you improve about the course?"

Theme	Description	Example	Mentions
Content load and pace	Concern about the fast delivery of topics and high information density	"Too much content in such a short time. I love the course, but everything was too fast and didn't allow me to learn in depth."	9
Infrastructure and physical resources	Requests for improvements in labs, access to real specimens, or more immersive anatomy practice	"There should be an anatomy lab, or at least let us dissect some animal organ."	6
Interactivity and classroom dynamics	Desire for more active classes: games, interactive worksheets, and group activities	"I'd make it more practical, less theoretical, to improve and reinforce my learning—like using Kahoot or a quiz at the end of the class."	7
Assessment and academic integrity	Suggestions for stricter exams and measures to prevent dishonest practices	"Be more strict in exams because some people don't pay attention and get high scores by taking photos and using AI to answer the questions and cheat."	4
Positive feedback without suggestions	Students who expressed overall satisfaction and did not suggest changes	"Nothing, I liked everything."	22

Note. Themes were identified through thematic analysis of open-ended responses from second-year Nutrition students at Rafael Landívar University (n = 48).

Tab.5. Main themes from the qualitative analysis of the question "What advice would you give to future students taking this course?"

Theme	Description	Example	Mentions
Consistent study from the beginning	General recommendation to study progressively, avoid content accumulation, and review after each class	"Start studying from the beginning, because it's a pretty complex course, and you'll eventually realize that everything is connected—even the smallest details matter."	18
Attention and active participation	Emphasis on paying attention, taking notes, and asking questions to enhance learning	"Pay attention in every class so you don't lose track of the material."	9
Use of complementary resources	Advice to consult textbooks, watch videos, make concept maps, or research independently	"Check other sources, make summaries or concept maps, watch videos to understand each topic better. It's especially useful for quizzes and exams."	7
Visual and technical understanding	Suggestion to use drawings, models, or diagrams to reinforce understanding of structures and functions	"The course is mostly visual and conceptual, so it's more important to understand the functions and locations than to memorize every structure's name."	7
Recognition of teacher's role and motivation	Expressions of gratitude to the teacher and motivation for future students to take advantage of the course	"Make the most of it because the professor is very dedicated and makes learning easier."	5

Note. Themes were derived from qualitative analysis of responses from second-year Nutrition students at Rafael Landívar University (n = 48), answering an open-ended question about advice for future cohorts.

Discussion

The results of this study demonstrate that the implementation of a mixed methodology in the teaching of Anatomy was highly valued by Nutrition students, both in quantitative and qualitative dimensions. All evaluated strategies received mean scores above 4.5 on a Likert scale, with multiple-choice assessments obtaining the highest average (M = 4.98), followed by coloring worksheets (M = 4.60) and the creation of anatomical models using modeling clay (M = 4.58). These data reflect a preference for visual, structured methods that facilitate knowledge consolidation.

From a qualitative perspective, students identified activities that combined visual, manipulative, and experiential components as the most useful. This finding aligns with Estai and Bunt (2016), who highlight the value of three-dimensional learning in Anatomy. Museum visits and laboratory sessions were also appreciated for their ability to contextualize learning, thus promoting situated learning (Lave & Wenger, 1991).

Moreover, the teacher's role was frequently mentioned as a facilitating factor in the learning process, reinforcing the principle that the quality of instructional design depends not only on the resources used but also on pedagogical mediation (Biggs & Tang, 2011). A total of 87.5% of participants expressed interest in applying this methodology in other courses, suggesting high acceptability of the model. Notably, a closer analysis of the qualitative responses—particularly those summarized in Table 4—provides critical insights into student-identified areas for improvement. Several participants emphasized that "too much content in such a short time" hindered their capacity for deeper learning, signaling an urgent need to review and calibrate both content density and instructional pacing. This observation is consistent with contemporary literature that identifies excessive workload as a key challenge in health sciences education (Biggs & Tang, 2011; González et al., 2021). Students proposed practical solutions, such as allocating additional time to core anatomical topics and increasing the frequency of immersive laboratory or hands-on activities, aligning with evidence-based recommendations for active, multisensory education (Estai & Bunt, 2016; Cordeiro et al., 2025). Additionally, there was a clear demand for more interactive approaches—such as integrating tools like Kahoot—in order to promote engagement and reinforce concepts. Recent research further supports the use of smart educational technologies, including virtual and augmented reality, for enhanced anatomy learning experiences (Li & Tang, 2025).

A particularly salient theme concerns the growing role of digital technology and academic integrity. A subset of students expressed apprehension about the unauthorized use of artificial intelligence tools during examination processes, describing incidents where "students take photos and use AI to answer the questions and cheat." This feedback highlights an evolving ethical and practical challenge, one that is recognized internationally as AI becomes more pervasive in educational assessment (Li & Tang, 2025; Ekaterina et al., 2025). It is therefore imperative that assessment strategies and invigilation protocols be continuously updated to safeguard the validity and credibility of academic outcomes. Incorporating student feedback in this domain is essential for keeping pace with digital trends while upholding ethical standards (Habibi et al., 2024).

Collectively, these reflections not only validate the mixed methodology as a robust pedagogical model but also serve as a timely reminder of the importance of adaptability in curricular design. By institutionalizing regular reviews of content load, resource allocation, and exam integrity protocols, programs can remain responsive to student needs and the shifting landscape of health science education (Li & Tang, 2025).

Conclusions

The mixed methodology implemented in this Anatomy course successfully combined traditional and active strategies, achieving a high level of student acceptance. The integrated analysis shows that the combination of structured lectures, visual tools, and experiential activities enhanced the understanding of complex content and fostered a positive perception of the learning process. These

findings support the incorporation of hybrid methodologies as a pedagogical model in health sciences education.

Recommendations

- Maintain and institutionalize the use of visual and manipulative materials (worksheets, models, digital resources).
- Incorporate guided visits, case analysis, and applied activities that connect theoretical knowledge with professional practice.
- Train educators in active and mixed methodologies that promote meaningful learning.
- Regularly evaluate student perception to continuously improve pedagogical design.

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Appendices: Data collection instrument

Impacto de una metodología mixta en la enseñanza de Anatomía para estudiantes de Nutrición

A continuación se presenta un formulario como herramienta de investigacion para determinar la experiencia del estudiante frente al uso de una metodología mixta de enseñanza en anatomía. Los datos son totalmente anónimos, gracias por su participación.

* Indica que la pregunta es obligatoria

SECCIÓN 1: INFORMACIÓN GENERAL

1. Edad *

Marca solo un óvalo.

- Menos de 20 años
- 20 a 22 años
- 23 años o más

2. Sexo *

Marca solo un óvalo.

- Femenino
- Masculino
- Prefiero no responder

3. ¿Habías recibido antes algún curso relacionado con Anatomía? *

Marca solo un óvalo.

- Sí
- No

SECCIÓN 2: PERCEPCIÓN DE LA ENSEÑANZA

4. Las clases magistrales con dibujos en el pizarrón facilitaron mi comprensión de los temas.

Marca solo un óvalo.

1	2	3	4	5
○	○	○	○	○

5. La visita al museo de Anatomía ayudó a contextualizar el conocimiento teórico.

Marca solo un óvalo.

1	2	3	4	5
○	○	○	○	○

6. La elaboración de modelos anatómicos con plasticina mejoró mi aprendizaje.

Marca solo un óvalo.

1 2 3 4 5

7. Las hojas de trabajo para colorear reforzaron mi conocimiento de estructuras anatómicas.

Marca solo un óvalo.

1 2 3 4 5

8. La elaboración de un video me ayudó a estudiar y comprender mejor el contenido.

Marca solo un óvalo.

1 2 3 4 5

9. La discusión de casos clínicos me permitió aplicar lo aprendido a situaciones reales.

Marca solo un óvalo.

1 2 3 4 5

10. Las evaluaciones mediante opción múltiple y casos fueron adecuadas para medir mi aprendizaje.

Marca solo un óvalo.

1 2 3 4 5

11. El curso fomentó mi interés por la Anatomía.

Marca solo un óvalo.

1 2 3 4 5

12. El profesor demostró dominio del tema y buena disposición para resolver dudas.

Marca solo un óvalo.

1 2 3 4 5

13. La metodología mixta me pareció adecuada para aprender un tema complejo como Anatomí

Marca solo un óvalo.

1 2 3 4 5

14. Sentí que el curso incluyó demasiada información en poco tiempo.

Marca solo un óvalo.

1 2 3 4 5

15. Las actividades creativas hicieron el aprendizaje más dinámico.

Marca solo un óvalo.

1 2 3 4 5

SECCIÓN 3: APLICABILIDAD Y RENDIMIENTO

16. Considero que lo aprendido en este curso será útil para mi formación como nutricionista.

Marca solo un óvalo.

1 2 3 4 5

17. Me sentí motivado(a) a estudiar esta asignatura.

Marca solo un óvalo.

1 2 3 4 5

18. ¿Te gustaría que este tipo de metodología se aplicara en otros cursos de la carrera?

Marca solo un óvalo.

- Sí
- No
- Tal vez

Sección 4: PREGUNTAS ABIERTAS

19. **¿Cuál fue, en tu opinión, la actividad más útil para tu aprendizaje? ¿Por qué?**

20. **¿Qué aspectos del curso cambiarías o mejorarías?**

21. **¿Qué consejo darías a futuros estudiantes que tomarán esta asignatura?**