

# EXPLORING INTERACTIVE STRATEGIES FOR TEACHING PATHOLOGY IN NURSING GRADUATION IN SOUTHEAST BRAZIL

## EXPLORANDO ESTRATÉGIAS INTERATIVAS PARA O ENSINO DE PATOLOGIA NA GRADUAÇÃO EM ENFERMAGEM NO SUDESTE DO BRASIL


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**Resumo:** A pandemia de COVID-19 trouxe desafios para a educação, ressaltando a necessidade de soluções inovadoras no ensino da saúde. Desde 2002, o MEC recomendou metodologias ativas nas Diretrizes Nacionais Curriculares (DNCs). Este estudo avalia o ensino de Patologia em cursos de Enfermagem em IES públicas no Sudeste do Brasil. Também analisa as opiniões dos alunos sobre a tutoria de pós-graduandos na UNIFESP. Foram coletados dados de 21 cursos de Enfermagem e formulários da UNIFESP entre 2019 e 2023, durante a implementação do programa de aperfeiçoamento didático (PAD). A análise foi estatística. Os resultados indicam a necessidade de ajustes curriculares, devido à falta de padronização na carga horária de Patologia, com variações na estrutura e metodologia. Em relação à metodologia ativa, 90% dos alunos da UNIFESP a consideraram muito boa.


**Palavras-chave:** estratégias interativas, ensino, patologia, carga horária, metodologia ativa


**Abstract:** The COVID-19 pandemic posed challenges for education, emphasizing the need for innovative teaching solutions in healthcare. Since 2002, the Ministry of Education recommended active methodologies in Nursing Curricular Units (CUs). This study aims to assess the Pathology CU teaching in Nursing courses at public universities in southeastern Brazil. It analyzes student feedback on tutoring by postgraduate students through a questionnaire given to third-semester undergraduates at the Federal University of São Paulo (UNIFESP). Data from 21 public university syllabi and UNIFESP student forms from 2019 to 2023 during the implementation of the Didactic Improvement Program (DIP). Descriptive statistics were used for analysis. Results indicate the need for curriculum adaptation due to variations in pathology workload, structure, methodology, and


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class distribution across healthcare courses. Overall, 90% of UNIFESP nursing students rated the CU's active methodology initiative as very good.

**Keywords:** Interactive strategies, teaching, pathology, workload, active methodology

## 1. Introduction

The formation of healthcare professionals requires solid, up-to-date teaching in pathology, since the knowledge in this field included on the basic cycle of formation is essential to diseases treatment and diagnosis (SALLES et al, 2022). Over the centuries, multiple researchers and scientists have contributed significantly to the evolution of healthcare knowledge, leaving a legacy that has changed the way how medicine is practiced today. Hippocrates, in Ancient Greece, associated diseases to bodily humors, establishing one of the first medical theories. The 15th century brought the contribution of Pope Nicolau V, who based himself on the studies of Cornelius Celsus to identify the four signs of inflammation. It was in this period that the concept of Pathological Anatomy emerged with Antonio Benivieni, bringing the base for the study of tissue and organ alterations due to disease (MORTIMER et al, 2008; ROSAI, 1997).

The discovery of the microscope by Hans and Jansen in the 16th century and its subsequent use by Robert Hooke in the 18th century to describe cells, marked a watershed in the history of medicine. This advance allowed a deeper understanding of microscopic structures of human body and opened up the way for the development of Histopathology. In the 19th century, Rudolf Virchow, considered the father of modern pathology, was a public health activist and advocate, and his observations and recommendations of ways to improve people's health by getting better their economic and social conditions are well known, thus, he was one of the social epidemiology medicine forerunners, while Morgani stood out for being the pioneer in correlating clinical findings with morphological ones. The 20th century was marked by the formalin discovery through Butlerov, who has a changing impact because he became an essential agent in preservation of biological tissues for histopathological analysis (FARIAS et al, 2015; LIPSICK, 2021; ROSAI, 1997).

Thus, with the evolution of pathology knowledge in the beginning of 21st century, it was necessary to propose a new educational approach, creating several challenges for both educators and students. In Brazil this approach, recommended by the National Curricular Guidelines (NCGs) of the Ministry of Education (MEC) since 2001, aims to create more prepared professionals, more reflective and able to face the challenges of clinical practice with competence and empathy (ADAMY et al, 2021; SOARES et al, 2016).

This context creates a reflection on health care education, which is crucial on human life and must be continuous, transformative and innovative, keeping in mind collective and consensual reality, as Paulo Freire defended. Through it, the society acquires the knowledge needed to understand, prevent, and treat the various health conditions that impact people's quality of life (ROZENDO et al, 2017). In medical context, the willingness to understand the mechanisms of disease has been a constant challenge, since the knowledge was empirical and illnesses were attributed to divine punishment or spells (LIPSICK, 2021).

The curricularization of undergraduate health care courses, in line with the National Education Plan (NEP) 2014-2024, represents a significant step for improving the training of health professionals, encompassing a lot of campus, including traditional degrees such as medicine and nursing. However, the effective implementation of these guidelines needs a constant search for innovative teaching strategies aligned with the needs of the 21st century (MEHANNA et al, 2021; “Vantagens e limitações do Serious Games no ensino da enfermagem”, 2021).

The implementation of active methodologies combined with NEP (National Education Plan) enables a more dynamic and interactive approach on the teaching-learning process, promoting the development of essential skills such as critical thinking, the capacity to solve problems and work as a team (RUTES et al, 2015; WEINSCHREIDER et al, 2023).

In 2018, at the Federal University of São Paulo, it was established the Didactic Improvement Program (DIP), aiming to improve the teaching practice of postgraduate students. This program showed itself very important, contributing significantly to the participants learning, and it also played a fundamental role in supporting teachers in their activities and interactive dynamics in the classroom (SALLES et al, 2022).

In this context, in March 2020, the COVID-19 pandemic exposed the urgent necessity of innovative solutions in the field of education at our universities, pointing out the relevance of adopting new teaching approaches in the health area (LELLIS-SANTOS et al, 2020). Nevertheless, with the pathology advance and the increasing need for innovative teaching methods, it came up the necessity of exploring new techniques to improve pathology teaching. One of the bests interactive digital tools is the virtual simulator that can revolutionize the way pathological concepts are problematized and transmitted to students (BRANDÃO et al, 2008; KONONOWICZ et al, 2019; “Vantagens e limitações do Serious Games no ensino da enfermagem”, 2021). However, the lack of standardizing on the curriculum syllabi and the shortage of practical classes is a challenge faced by many educational institutions. It is crucial to promote a more consistent and interactive training, reaching the updating teaching resources (WEINSCHREIDER et al, 2023).

So, the comprehension of the challenges and benefits of implementing active methodologies in the training of nursing professionals could help to improve the curricularization of undergraduate health care courses, aiming not only the strengthening of the health care system, but also of the service demands of Brazilian society. Furthermore, this study aims to analyze the insertion of active methodologies in the teaching of Pathology in Nursing courses at public Higher Education Institutions (HEIs) in Southeast Brazil, highlighting UNIFESP, considering the curricularization of undergraduate health care courses, following the guidelines of the NEP. The research looks for evaluate the national panorama of the teaching of the Pathology Curricular Unit, as well as the perception of the 3rd semester Nursing students about the proposed methodological approach, intending to contribute to the improvement of the training of health care professionals who are better prepared and aligned with the needs of Brazilian society.

## 2. Methods

This research performed a mixed approach, including a document analysis and an application of an evaluation formulary to a convenience sample.

The first documental stage occurred between 12/03/2023 and 04/04/2023 by surveying, systematizing and analyzing the syllabuses of nursing courses offered by public Higher Education Institutions in the Southeast region of Brazil. At first it was collected data about the syllabus/teaching plan of 21 bachelor's degree nursing courses. The second part involved an implementation of the DIP strategy evaluation at one of the universities in the sample (Figure 1). The descriptive analysis allowed the comprehension of syllabus contents and teaching approaches adopted in the Pathology Curricular Units.

Then, to obtain the students' perception related to pathology CU at UNIFESP, the formulary applied to undergraduates at the end of the course from 2019 to 2023 was evaluated. The questionnaire was an instrument of the subject itself (secondary data). It was structured to cover multiple aspects of the teaching-learning process, including the contents taught, the adequacy of the material used, the organization of the coordination and the teachers responsible for the subject. Besides that, it aimed to evaluate the trainees' contribution on the CU development.

The data analysis of the 135 participants during 4 years was conducted by descriptive statistics which feasibility to identify trends, patterns and relevant correlations. The obtained results through statistical analysis were interpreted and compared with the NEP guidelines of 2014-2024 and the MEC recommendations for teaching pathology in nursing courses.

## 3. Results and Discussion

### 3.1- Differences and impacts of the diversity of Pathology CU teaching

Based on the collected data, Table 1 shows the principal characteristics of the Nursing course at public institutions in south-eastern Brazil, the significant differences in the workload and teaching method of the Pathology course were highlighted.

*Table 1. Main characteristics of nursing courses at public institutions in south-eastern Brazil according to the e-MEC system*

	University	Pathology workload	Pathology course period	Practical classes	Practical workload	Method
1	Universidade Federal de São Carlos	60h	3rd year/5th period	Yes	15h	Interdisciplinary
2	Universidade Estadual de Campinas	45h	2nd year/3rd period	No	-	Traditional
3	Universidade de São Paulo	45h	2nd year/3rd period	No	-	Traditional
4	Universidade Estadual Paulista Júlio de Mesquita Filho	30h	2nd year/3rd period	No	-	Traditional

5	Faculdade de Medicina de São José do Rio Preto	60h	2nd year/3rd period	No	-	Traditional
6	Faculdade de Medicina de Marília	PBL	PBL	Yes	-	PBL
7	Universidade Federal de São Paulo	72h	2nd year/3rd period	No	-	Traditional
8	Universidade do Estado do Rio de Janeiro	90h	2nd year/3rd period	Yes	60h	Traditional
9	Universidade Federal Fluminense	40h	2nd year/3rd period	No	-	Traditional
10	Universidade Federal do Rio de Janeiro	30h	2nd year/3rd period	No	-	Traditional
11	Universidade Federal do Estado do Rio de Janeiro	60h	2nd year/3rd period	Yes	30h	Traditional
12	Universidade Federal de Viçosa	60h	2nd year/3rd period	No	-	Traditional
13	Universidade Federal de Uberlândia	45h	2nd year/3rd period	Yes	15h	Traditional
14	Universidade Estadual de Montes Claros	40h	2nd year/4th period	No	-	Traditional
15	Universidade Federal de Minas Gerais	60h	2nd year/4th period	No	-	Traditional
16	Universidade Federal de Juiz De Fora	45h	3rd year/5th period	No	-	Traditional
17	Universidade Federal de Alfenas	75h	2nd year/3rd period	No	-	Traditional
18	Universidade Federal dos Vales Do Jequitinhonha e Mucuri	90h	2nd year/4th period	Yes	30h	Traditional
19	Universidade Federal do Triângulo Mineiro	90h	2nd year/4th period	Yes	50h	Traditional
20	Universidade do Estado de Minas Gerais	60h	1st year/2nd period	No	-	Traditional
21	Universidade Federal do Espírito Santo	75h	2nd year/4th period	Yes	30h	Traditional

Source: <https://emec.mec.gov.br/emec/nova>

The Universidade Federal de São Carlos (UFSCAR) offers an interdisciplinary Bachelor of Nursing course, with a 60-hour workload for Pathology, including practical classes corresponding to 15 hours (25% of the workload).

On the other hand, other institutions such as the Universidade Estadual de Campinas (UNICAMP), Universidade de São Paulo (USP), Universidade Estadual Paulista Júlio De Mesquita Filho (UNESP) and Faculdade de Medicina de São José Do Rio Preto (FAMERP) do not report specific practical classes for Pathology, suggesting a traditional teaching approach. UNICAMP

has the Didactic Support Program described in the syllabus, including serious games projects in the undergraduate nursing course.

Active methodology is an educational approach that the student is the center of the teaching-learning process, promoting their active participation and engagement. This methodology seeks to break with traditionalism, offering new teaching perspectives that favor the experience of real situations and the construction of meaningful knowledge. Developing skills such as critical thinking, autonomy and responsibility for one's own learning, allowing students to integrate theory and practice more effectively is the mission of this method (GHEZZI et al, 2021).

The Faculdade de Medicina de Marília (FAMEMA) stands out for having a Problem-Based Learning (PBL) course. The nursing bachelor degree has 60 hours of pathology. This interactive approach allows a better correlation between theory and practice, enabling a more comprehensive and applied experience for the students on the pathology study.

Meanwhile, the Universidade Federal de São Paulo (UNIFESP) offers the longest workload of 72 hours in pathology, without practical laboratory classes but including extension activities such as the project “Clube do saber” which practically plays this role through the CU final proposal itself, that included creating a product to explain pathology to the population in a simple and educational way, as well as prevention campaigns. In the nursing class of 2023, some examples of the final products were: games, podcasts, short videos, booklets, posts.

The Universidade do Estado Do Rio De Janeiro (UERJ) offers a 90 hours workload of pathology, including 60 hours of practical activities (66% of the workload), following a traditional approaching of teaching. It stands out for having the largest number of practical classes of any university in the southeast.

Conversely, the Universidade Federal do Estado do Rio De Janeiro (UNIRIO) offers 60 hours of pathology with 30 hours of practical classes (50% of the workload), also adopting a traditional approach. Among the other institutions, the Universidade Federal de Viçosa (UFV), Universidade Federal de Uberlândia (UFU) and the Universidade Federal dos Vales Do Jequitinhonha E Mucuri (UFVJM) stand out for offering 60 hours of Pathology with theoretical and practical activities involved in an integrated way.

The other institutions in the Southeast presented a more traditional approach, with a workload between 30 and 75 hours, and some of them do not offer specific practical classes for pathology.

Results shows that the implementation of the interdisciplinary approach, such as UFSCAR and PBL in FAMEMA allows a more comprehensive formation and applied to pathology study, promoting a greater correlation between theory and practice in the teaching-learning process. On the other hand, the predominant more traditional approaches in other institutions could be reviewed to incorporate active methodologies, such as practical classes, looking into improving the formation of future nursing professionals according to the guidelines of the PNE 2014-2024 (FARIAS et al, 2015).

Facing this lack in literature about this theme in nursing courses, we could confront the panorama found with a study conducted by HUMPHREYS et al (2020), who researched the situation of pathology in six Irish medical schools where the pathology CU was recognized as a central subject was generally taught in the second or third year, with the most contact hours with histopathology (44-102 hours). The most common teaching method was expository classes, and all of them used multiple-choice, matching, or single-best-answer questions as part of the evaluations. This study pointed out that there was a huge reliance on non-academic hospital staff and lectures in the classes, which needed to remain relevant with the change to thematic and case-based teaching.

Our findings corroborate the literature, revealing that most HEIs in the southeast of Brazil offer the subject of pathology in the second year of the nursing course. Of the 21 HEIs analyzed, 12 taught the subject in the third period of the second year, while 5 offered it in the fourth period of the same year. Two institutions included the subject in the fifth term of the third year, and only one offered it in the second term of the first year. It is worth noting that, in addition to these HEIs, Famema adopts an integrated approach, based on PBL, for teaching pathology.

GROVER et al, (2017) used a teaching-learning method in which the students act as professors, helping the other students to learn while they are also learning by teaching. This method included role-plays, student-led seminars, blackboard teaching, demonstrating pathogenesis using props, case-based learning exercises, multiple-choice question seminars, and quizzes before teaching sessions. Peer-assisted learning complemented by modified interest-building activities can be adopted to make teaching and learning more effective and interesting through active participation and student involvement.

The use of simulators provides an environment in which participants can practice clinical reasoning, follow the path to the correct diagnosis, apply effective interventions and solve clinical-diagnostic problems. This is done with the advantage of allowing repetition without causing burden or physical risk to academics, health professionals or patients. This approach creates a safe space for the teaching-learning process, where mistakes are allowed and become opportunities for constructive learning. When reviewing the literature, only 13 articles were identified that address gamification or simulation applied to the teaching of pathology. The on going work proposes integrative strategies utilizing digital simulators to optimize pathology teaching (Krishnamurthy et al, 2022).

### 3.2- Impact of PG and undergraduate interaction in the Pathology CU

The data presented in Table 2 shows an evaluative history of the activities developed in the DIP in General Pathology and Systems of a nursing course of an HEI included in the sample from 2019 to 2023 (Table 2). This activity and its respective evaluation have already been a part of the course syllabus, characterizing an evaluation of secondary data obtained by analysing the evaluation forms from 2019 to 2023.

Table 2. Evaluation of the Didactic Improvement Program in General and Systems Pathology - Unifesp

Year	n	Activities carried out by the DIPs			
		Very good	Good	Reasonable	Bad

2019	27	92%	4%		4%
2020	25	80%	8%	12%	
2021	28	93%	7%		
2022	29	86%	9%	5%	
2023	26	92%	4%		4%

Source: Assessment Questionnaires for the DIP (Didactic Improvement Program) of the Pathology curricular unit of the Nursing classes of the aforementioned years carried out through Google Docs

The results of these evaluations indicate a good general perception of students regarding both the Nursing Undergraduate Course and the General and Systems Pathology DIP of the HEI, analyzed throughout this period through an evaluation form in Google Docs. Most students considered the course “very good”, which means that the activities proposed by the course coordinator and the activities suggested by the students were well accepted and met the students’ expectations regarding the teaching of Pathology at the university.

Among the experiences of postgraduates participating in UNIFESP's DIPs are the preparation of study guides for classes taught by full and assistant professors, contributing to complementary activities, helping with the CU’s final work, and collaborating in the assembly and correction of exams under the supervision of the professor in charge. These activities play an important role in the qualified training of master's and doctoral students (SALLES et al, 2022).

In the experience of the Unifesp postgraduate students who acted as monitors, the Kahoot interactive tool was used during the pre-test reviews. An increase in student engagement was observed, as well as a positive response in terms of pathology learning performance, when compared to previous years in which there was no directed study before the assessments. Future studies plan to evaluate the impact of gamified lessons, using validated questionnaires applied before and after the exams, in order to measure the effectiveness of the method and the retention of knowledge (ROJAS-MANCILLA et al, 2019).

At the beginning of the Pathology course, 10 topics related to systemic pathology are presented, on which the students must develop a final product. During the course, the tutors, who are postgraduate students, guide the students in the development of their work, using the inverted classroom methodology. This means that the students study the topic beforehand and come up with questions and proposals for the projects. In our experience, two projects from Nursing class 83, in 2023, received an honorable mention: a board game on pathologies of the male urogenital system, aimed at teenagers, and an eBook on mumps, with figures and puzzles for children, designed to promote interaction with parents, using language accessible to the population (Krause, 2024).

These integrative methodologies are based on the concept of active methodologies, such as problem-based learning, the inverted classroom and team-based learning (table 1). At the end of the course, the students evaluate the subject and the DIPs, considering aspects such as the teaching material provided, the tutorials, the classes taught by the DIPs and the general interaction. Table 2 shows the results of the student evaluation forms between 2019 and 2023.

Chart 1 - Interactive strategies used in the Systemic Pathology CU

Concept	Activities nursing students
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Inverted classroom	Tutorials for the final product
Team-based learning	Case study, students worked in teams to solve the problem and fix the concept
Problem-Based Learning	The student, as the center of the learning process, must solve a complex problem, using scientific articles as a basis, to compose the final product
Innovation	Kahoot, gamification and digital simulator

Source: Based on Francischetti et al, (2022)

This favourable evaluation of the CU reinforces the importance of initiatives to improve the quality of teaching and the involvement of students in the learning process. The program seems to contribute in a significant way to the academic formation of nursing students bringing a strong base to improve the curricularization of the course and meet the guidelines of the NEP 2014-2024 regarding the teaching of Pathology and the development of active methodologies in health education.

The implementation of active methodologies on the teaching process, such as practical classes and other DIP activities, have been essential to promote more extensive and applied training for nursing students. Institutions such as UFSCAR and FAMEMA, which offer more integrated courses and practical activities in pathology, seem to provide a better experience to the students and are closer to professional practice.

On the other hand, it was observed that some institutions still follow a traditional teaching approach, with a reduced workload for pathology including few or no practical activities. This approach can limit the students' experience in the practice and application of the acquired knowledge, which can affect the formation of professionals better prepared and able to meet the needs of the health care system and society.

The data analysis also highlights the importance of curricularizing undergraduate health courses according to the guidelines of the PNE. Not only the implementation of teaching improvement programs, but also the program showed on the second part of the study contributes to the improvement of pathology teaching and other subjects, engaging students and providing a more qualified education.

The positive evaluation of the CU and the DIP within the undergraduate nursing curriculum, recognized by the students, reinforces the importance of investing in initiatives that promote the continuous improvement of academic training and spaces for PG and undergraduate interaction.

With the increase of the emerging infectious diseases, the antibiotic resistance and the growing number of immunocompromised patients, there is a growing demand for expertise in microbiological testing and infectious diseases (ID) pathology. PYDEN et al, 2023 emphasizes the value of a training model that wants to integrate clinical pathology, anatomical pathology, and molecular pathology, providing case-based examples presenting selected metrics of the potential effect of this integrative pathology identification service and briefly describing

challenges and opportunities of global health efforts in Rwanda. This paradigm change opens up a field of study and research for new studies with interactive tools designed for teaching pathology, for example through virtual simulators (KONONOWICZ et al, 2019).

MCBRIEN et al, (2019) concluded that the mainly part of the studies which describes educational interventions in pathology do not have a strong experimental design. Consumers of educational research should be aware of potential weaknesses in educational studies, which corroborates that the insertion of active methodologies in pathology teaching is necessary at a global level.

RODRIGUES et al, (2022) conducted a study during the COVID-19 pandemic involving third and fourth year medical students in remote Pathology teaching. Methods included live lectures, recorded lectures, case-based discussions and online materials. Students saw benefits in the flexibility of study and the interactive live lectures, although they faced challenges such as the difficulty of separating study from domestic activities and a lack of motivation. Overall, 80% of the students rated the remote teaching of pathology positively, suggesting that this experience could be a model for future teaching methods in the health sciences.

GUREVICH et al, (2020) reinforce that the Integration of Interprofessional Education (IIE) in higher education curricula is crucial to promote interprofessional partnerships between nurses and speech therapists, looking forward the patient care. Nevertheless, the lack of adequate educational opportunities persists due to curricular inadequacy. One of the proposed solutions is the use of a collaborative electronic platform, which can overcome the time and resources, reaching the professionals necessities and reflecting telehealth trends in health care professions WEINSCHREIDER et al, (2023). New studies must validate the efficiency of this approach promoting interactivity, interdisciplinarity and case discussion using new methodologies such as virtual simulators in the teaching process.

## 4. Limitations

The limitations of the present study are shown by the lack of information about the extension programs in the undergraduate nursing courses analyzed. The syllabus, which was the principal evaluation focus, did not offer specific details about the extension activities, limiting the understanding of the full panorama of these programs. Also, it is important to point out data collection was restricted exclusively to e-MEC and the syllabuses available on the websites of HEIs.

## 5. Conclusion

Based on the partial recognition of the teaching profile of the Pathology curriculum unit in Nursing courses in Brazil, it is crucial to highlight the need for a more standardized curriculum in Nursing education. This underscores the significance of the curriculum contents in shaping health professionals, demonstrating that the methods employed in teaching directly impact the future practice of nursing professionals.

Besides that, it is important to emphasize the Insertion of Graduate Students (IGS), aiming to contribute to and enrich the CU activities mainly through the students' interaction, who feel more comfortable clarifying doubts with the IGS.

Therefore, reinstating the minimum workload and integrating practical classes—whether through traditional approaches or innovative methodologies—are crucial to this process and would greatly enhance the effective implementation of the National Curriculum Guidelines (DNCs) for health training. These improvements not only foster a more engaging learning environment but also support the overarching goal of curricularization in health education.

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