Original Article

"*Enfermeiro Diagnosticador*" board game for teaching diagnostic reasoning in nursing: a quasi-experimental study

Jogo Enfermeiro Diagnosticador para ensino do raciocínio diagnóstico em enfermagem: estudo quase-experimental

Juego Enfermero Diagnosticador para la enseñanza del razonamiento diagnóstico en enfermería: estudio cuasi experimental

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Abstract

Objective: To assess the "*Enfermeiro Diagnosticador*" board game effectiveness for teaching diagnostic reasoning among nursing students.

Methods: This is a quasi-experimental study, developed in three stages: "*Enfermeiro Diagnosticador*" (Diagnostician Nurse) game construction; content analysis of clinical cases by experts; and "*Enfermeiro Diagnosticador*" game application. Nineteen experts participated in content analysis. Pre- and post-tests were performed with 11 undergraduate nursing students, attending semiology, a baseline subject.

Results: The nine clinical cases that comprised the game were organized into clues capable of subsidizing the composition of nursing diagnoses. These were assessed with good suitability by 19 experts in diagnostic reasoning and/or educational technology. Comparing students' performance before and after the experiment, the correct diagnostic inference showed a statistically significant difference in the resolution of the first and second diagnoses (p=0.008). Moreover, the correct writing of diagnosis was a highlight in the post-test and all the items assessed showed improvement after the board game application.

Conclusion: It is concluded that "*Enfermeiro Diagnosticador*" is effective in supporting the teaching of diagnostic reasoning in nursing. In this way, we aim to advance in the state of the art with regard to low-cost and easily accessible educational games to support diagnostic reasoning in nursing.

Resumo

Objetivo: Avaliar a efetividade do jogo de tabuleiro Enfermeiro Diagnosticador para o ensino do raciocínio diagnóstico em estudantes de enfermagem.

Métodos: Estudo quase-experimental, desenvolvido em três etapas: construção do jogo de tabuleiro Enfermeiro Diagnosticador; análise de conteúdo dos casos clínicos por especialistas; e aplicação do jogo de tabuleiro Enfermeiro Diagnosticador. Participaram 19 especialistas na análise de conteúdo. O pré-teste e o pós-teste foram realizados com 11 discentes do Curso de Graduação em Enfermagem, cursando a Disciplina de Bases da Semiologia.

Resultados: Os nove casos clínicos que compuseram o jogo foram organizados em pistas capazes de subsidiar a composição dos diagnósticos de enfermagem. Esses foram avaliados com boa adequação por 19 especialistas em raciocínio diagnóstico e/ou tecnologia educacional. Comparando o desempenho dos discentes antes e após o experimento, a inferência diagnóstica correta apresentou diferença estatística significativa na resolução do primeiro e segundo diagnósticos (p=0,008). Além disso, a escrita correta do diagnóstico foi ponto de destaque no pós-teste e todos os itens avaliados apresentaram melhora no momento pós-aplicação do jogo de tabuleiro.

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Conclusão: Conclui-se que o jogo de tabuleiro Enfermeiro Diagnosticador é efetivo no apoio ao ensino do raciocínio diagnóstico em enfermagem. Desta forma, almeja-se avançar no estado da arte no que concerne a jogos educativos de baixo custo e fácil acesso para dar suporte ao raciocínio diagnóstico em enfermagem.

Resumen

Objetivo: Evaluar la efectividad del juego Enfermero Diagnosticador para la enseñanza del razonamiento diagnóstico en estudiantes de enfermería.

Métodos: Estudio cuasi experimental desarrollado en tres etapas: elaboración del juego de mesa Enfermero Diagnosticador, análisis de contenido de los casos clínicos por especialistas y aplicación del juego de mesa Enfermero Diagnosticador. Participaron 19 especialistas en el análisis de contenido. El pretest y el postest se realizó con 11 estudiantes de la carrera de Enfermería que cursaban la materia Bases de la Semiología.

Resultados: Los nueve casos clínicos que formaban parte del juego fueron organizados en pistas que podían respaldar la composición de los diagnósticos de enfermería. Estos casos fueron evaluados con buena idoneidad por 19 especialistas en razonamiento diagnóstico o tecnología educativa. Al comparar el rendimiento de los estudiantes antes y después del experimento, la inferencia diagnóstica correcta presentó diferencia estadística significativa en la resolución del primer y segundo diagnóstico (p=0,008). Además, la escritura correcta del diagnóstico fue un punto destacado en el postest, y todos los ítems evaluados presentaron una mejora en el momento posterior a la aplicación del juego de mesa.

Conclusión: Se concluye que el juego de mesa Enfermero Diagnosticador es efectivo para respaldar la enseñanza del razonamiento diagnóstico en enfermería. De esta forma, se pretende avanzar en el estado del diseño en lo que respecta a juegos educativos de bajo costo y fácil acceso para respaldar el razonamiento diagnóstico en enfermería.

Introduction

The growing transformations experienced in the health-disease process bring out the need for an organized nursing work process, which allows achieving the skills and abilities required by the profession. Thus, the Nursing Process (NP) stands out as a methodological instrument, from the perspective of promoting organized work.[1] Diagnostic reasoning, fundamental to the development of NP, consists of reflective, concurrent, creative and critical thinking, which involves nursing practice, being an essential element for its development.[2]

The ability of diagnostic reasoning in nursing must be developed throughout nurses' training process, through attractive and interactive teaching strategies that encourage their active participation in the teaching-learning process. [3] In the context of professional training in nursing, the development of diagnostic reasoning skills faces some limitations, such as lack of effective educational methodologies, distance from theory to practice, classroom environment not conducive to development.[4]

Such difficulties are observed in undergraduate students' performance regarding diagnostic reasoning when submitted to traditional teaching strategies, from the identification of diagnostic indicators (defining characteristics and related/risk factors) to diagnostic inference.[3] This reality is reflected in clinical practice, which evidences nurses' lack of knowledge and skills in developing diagnostic reasoning.[5,6] That said, there is poorly qualified nursing care, increased job dissatisfaction and decreased scientific practice. [7]

In order to promote the diagnostic stage, there is a need to develop educational tools that explore diagnostic reasoning.[8] These tools aim to strengthen their critical thinking skills and problem solving.[9] Thus, educational technologies are developed to support the teaching of diagnostic reasoning in nursing.

Several tools are reported in the literature and, for the most part, refer to software or simulated games that reproduce the moment of care, indicating different ways of sharing and acquiring knowledge, motivating the teaching-learning process.[10] Among them, we can mention the T-NDx Diagram for teaching diagnostic reasoning linked to nursing theories, an instrument for assessing clinical reasoning based on the study of clinical cases in groups, in addition to an educational course associated with case resolution. [11-13]

Game-based learning has a high capacity for motivation and student involvement in the teaching-learning process.[14] Games, when applied from the perspective of nursing education, have the potential to enhance new nurses' clinical decision-making.[14] In addition to this, a review study showed that more robust research methodologies are needed to confirm best teaching practices through educational games in nursing. [14]

Therefore, the relevance of developing educational games that reflect low cost and easy dis-

semination of their use and that prove a positive impact on the diagnostic reasoning process in nursing stands out. Thus, the objective was to assess the "*Enfermeiro Diagnosticador*" (Diagnostician Nurse) board game effectiveness to teach diagnostic reasoning in nursing.

Through this study, we aimed to advancing the evidence that proves the importance of strategies with regard to the development of educational technologies, in addition to producing materials that are accessible and capable of transforming future nurses' educational reality from the perspective of diagnostic reasoning.

Methods

This is a quasi-experimental study, carried out in the first half of 2019, at a public university in northeastern Brazil. The study was developed in three stages: "*Enfermeiro Diagnosticador*" board game construction; content analysis of clinical cases by experts; and "*Enfermeiro Diagnosticador*" board game application. This report was prepared based on the CONSORT (Consolidation of reporting trials).

"*Enfermeiro Diagnosticador*" board game construction

The "*Enfermeiro Diagnosticador*" board game, proposed for teaching diagnostic reasoning in nursing, is characterized by clinical cases involving nursing diagnoses. The steps proposed by Gordon to operationalize diagnostic reasoning based on: information collection (with the provision of clues throughout the game); interpretation of the information collected (translation of clues to diagnostic indicators); information cluster (from the union of common diagnostic indicators); and cluster denomination (with diagnostic inference).[15]

The game is characterized by the search and organization of clues capable of evidencing the nursing diagnosis presented by patients. Thus, case cards were created, which include clinical cases that will support diagnostic reasoning. Such cards are the board game's skeleton, formed by an initial description of the clinical case with specific information to place students in the case they will solve, containing fictitious patient name and eight commands.

Commands are organized into five lanes, each of which represents a diagnostic indicator (diagnostic indicators are defining characteristics and related/risk factors) for students to achieve diagnostic inference. Furthermore, three commands were inserted to make the board game more dynamic, namely: return three squares; a guess at any time (whoever acquires the command will be able to infer the diagnosis before the others); and a golden clue (which presents the NANDA-International Taxonomy (NANDA-I) domain to which the diagnosis belongs).

The construction of clinical cases was carried out in order to compose the educational game. These followed the framework proposed by Lunney to construct clinical cases: resource and method selection, case objectives, complexity, evidence validity, guidance scripts and content validity.[16] Thus, nine cases were prepared from NANDA-I (2018-2020).[17]

These presented the same structure, consisting of five diagnostic indicators each, as well as the same level of difficulty, in different contexts. Thus, five cases were randomly selected to compose the educational game, and four were used to assess the game effectiveness during pre- and post-tests. This stage of this study occurred between August and December 2018.

Content analysis of clinical cases addressed in the game

In a second step, the content analysis of clinical cases was carried out by experts in diagnostic reasoning and/or educational technology, who should hold at least a master's degree in nursing. Thus, 32 experts were selected via the *Plataforma Lattes* (resume website), with these being teaching nurses who develop studies in the context of educational strategies and nurses who develop studies from the perspective of nursing diagnoses. Of these, 19 answered the questionnaire and assessed the clinical cases. This stage of this study occurred between January and May 2019.

The instrument was sent to experts via e-mail for assessing the suitability of the clinical cases, or-

ganized in clues, the inferred diagnosis and the level of complexity of the cases. These elements were judged by experts using a Likert-type scale, ranging from one to five, in which: One - indicated the non-suitability of the clinical case; Two - barely suitable; Three - somehow suitable; Four - pretty suitable; and Five - very suitable.[18] For each clinical case, a space was reserved for suggestions.

Experts' sociodemographic and academic data were analyzed using descriptive statistics. To verify case suitability, experts' answers using Likert-type scale were dichotomized, in which one, two and three indicated the items as not suitable, and the numbers four and five indicated the items as suitable. Cases with 80% or more suitability were maintained, and those with a lower percentage were reformulated according to experts' suggestions.

"*Enfermeiro Diagnosticador*" board game application

The "*Enfermeiro Diagnosticador*" board game application for diagnostic reasoning in nursing occurred from a quasi-experimental design study. This allowed testing undergraduate nursing students' diagnostic reasoning before and after the game application to assess its effectiveness. This stage of this study occurred in June 2019.

The study population consisted of undergraduate nursing students from a state university in northeastern Brazil, enrolled in the basic subject of nursing semiology and semiotechnics. The choice of the curricular component was based on the educational game's proposal, which aims to improve diagnostic reasoning as a NP stage.

The sample consisted of 11 students enrolled in the curricular component. Students enrolled in nursing semiology and semiotechnics who have participated in the subject lecture on NP and participated in pre-test, application and post-test were included. Students with previous failure in the curricular component and having previously studied the subject at another higher education institution were excluded.

Data collection took place through three meetings, the first being for introducing the game and applying the pre-test; the second was for applying the game on diagnostic reasoning; and the third was for the post-test instrument response. Data collection instruments were composed by student characterization, followed by two clinical cases, with a similar level of difficulty, containing a description of the case, five clues and space to infer the diagnosis. These were applied before and after the test.

There was the initial game application in a pilot test with three nursing students who made up the project team. The demands that arose regarding the suitability of rules and time to conduct the game were organized before applying the experiment. The pilot test and the experiment were applied by the researcher in charge. Pre- and post-test instruments, as well as their correction from the answer key, were applied to nursing students who were part of the project team and without access to the distinction between the instruments applied in pre- or post-tests.

The experiment guided by the "*Enfermeiro Diagnosticador*" board game application took place with the separation of 11 students into five groups (one group of three components and four groups of two components). The game's tutoring, conducted by the responsible researcher, began by explaining the rules, operating and reading the game's cases and commands. Afterwards, the five rounds were performed, showing the resolution of the five clinical cases.

The data obtained in this third stage were analyzed using descriptive statistics. Central tendency and dispersion measures were assessed, and their normality was tested using the Shapiro-Wilk test ($p<0.05$) as well as relative and absolute values for the nominal variables included in the instruments.

To compare pre- and post-test moments, the comparison of mean correct answers was performed using the McNemar test for intergroup comparison, adopting a significance level of 5% ($p\leq0.05$).

All ethical precepts have been respected. The project was approved by the institution's Research Ethics Committee, under Opinion 2.571.464 and CAAE (*Certificado de Apresentação para Apreciação Ética* - Certificate of Presentation for Ethical Consideration) 84373718.3.0000.5294.

Table 1. Analysis of clinical cases by experts

Clinical case	Case suitability		Nursing diagnosis		Degree of difficulty	
	Suitable*	Not suitable*	Suitable*	Not suitable*	High*	Low*
Adolescent at risk of overweight	84.2	15.7	78.9	21.1	15.8	84.2
Older adult with disturbance in sleep pattern	94.7	5.3	94.7	5.3	15.8	84.2
Carrier of arterial ulcer with chronic pain	89.5	10.5	94.8	5.7	36.9	63.1
Older adult in the postoperative period at risk of PPL	89.5	10.5	94.7	5.3	31.6	68.4
Hypertensive older adult with ineffective health control	89.5	10.5	89.5	10.5	52.6	47.4
Woman with urinary incontinence	78.9	21.1	94.7	5.3	31.6	68.4
Puerperal woman with ineffective breastfeeding	73.7	26.3	78.9	21.1	31.6	68.4
Adult male with low situational self-esteem	94.7	5.3	94.7	5.3	52.6	47.4
Adolescent with anxiety	84.2	15.7	94.7	5.3	26.4	73.6

[1]Value in percentage (%)

Results

The construction of the nine clinical cases occurred through clues to compose the board game. Thus, each clinical case was organized into five clues that reflect the signs and symptoms, as well as the etiologies or risk factors, which supported the identification of diagnostic indicators to compose the expected nursing diagnosis.

The nine clinical cases addressed the following themes: Adolescent at risk of overweight; Older woman with sleep pattern disorder; Carrier of arterial ulcer with chronic pain; Postoperative older adult at risk of pressure injury; Hypertensive older adult with ineffective health control; Woman with urinary Incontinence; Puerperal woman with ineffective breastfeeding; Adult male with situational low self-esteem; and Adolescent with anxiety.

The nine clinical cases were assessed by 19 experts. As for the sociodemographic characterization, the median age was 31 years (p=0.000), and they came from Rio Grande do Norte (73.7%), Ceará (10.5%), São Paulo (10.5%) and Pernambuco (5.3%).

They had an average of seven years (p=0.000) of nursing education and a higher master's degree (42.1%). As for professional activity area, teaching stood out (68.4%), followed by care and research, both with the same proportion (15.8%). And 78.9% use nursing diagnoses in their professional practice.

Table 1 presents the suitability of each clinical case, its expected diagnosis and level of complexity, assessed by experts.

The clinical cases showed good suitability as well as the inferred diagnoses were well assessed by experts. The suggestions sent to improve the clinical cases were analyzed and modified when relevant. Thus, after content analysis, clinical cases one and five were used at the pre-test moment, and cases eight and nine, at the post-test moment, since they presented compatible levels of difficulty for measuring the variable of interest, diagnostic reasoning. The remaining five clinical cases comprised the educational game. Thus, Figure 1 presents the "*Enfermeiro Diagnosticador*" layout, and Figures 2, 3 and 4, the game's card layout.

Thus, the game consists of a board with the space of five clinical cases and spaces to be covered between them. Each cynical case is solved separately, after solving the first one, we move on to the next one. In Figure 1, the board game layout is observed, containing the squares that direct the players to the clinical cases. Each player draws on the dice the number of squares to go. Each time they roll the dice and roam the board, they choose a number referring to a clue to the case that will be read by the tutor.

The objective is to go through the squares accumulating clues until reaching the case space. The one who reaches it first will be able to infer nursing diagnosis. The game also has pegs that represent diagnostician nurses to allow them to be identified when scrolling the board, in addition to a dice that helps in the drawing of the number of squares to be covered.

As for the cards that make up the game, there are case cards, covering clinical cases developed to support diagnostic reasoning. The card contains the initial description of the case that will be read by the tutor at the beginning of each round, in addi-

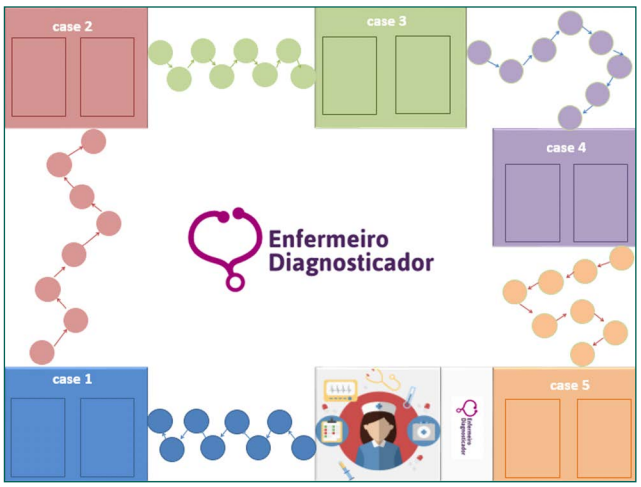

Figure 1. "*Enfermeiro Diagnosticador*" game layout

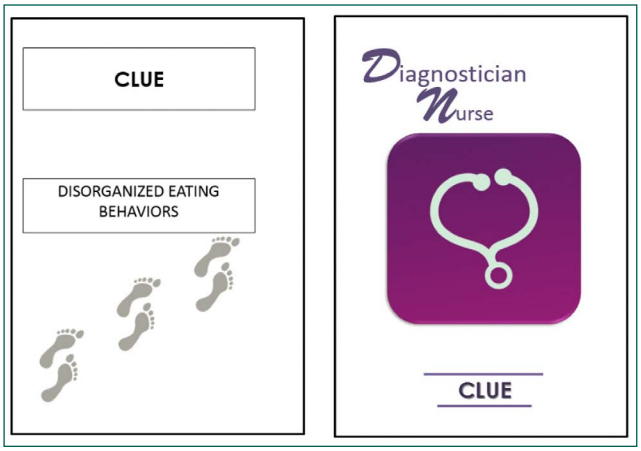

Figure 3. Double-sided layout of "*Enfermeiro Diagnosticador*" clue card

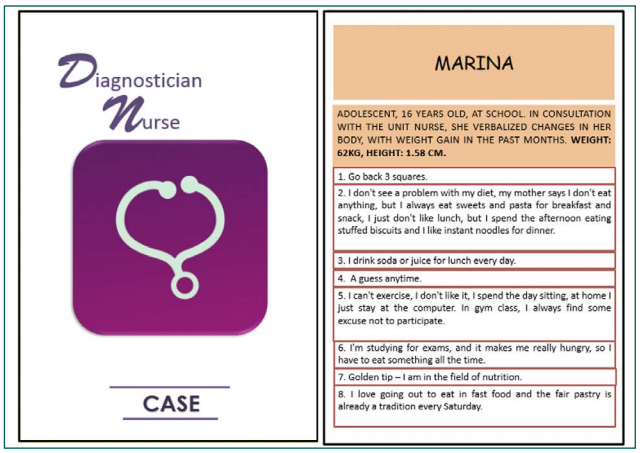

Figure 2. Double-sided layout of "*Enfermeiro Diagnosticador*" case card

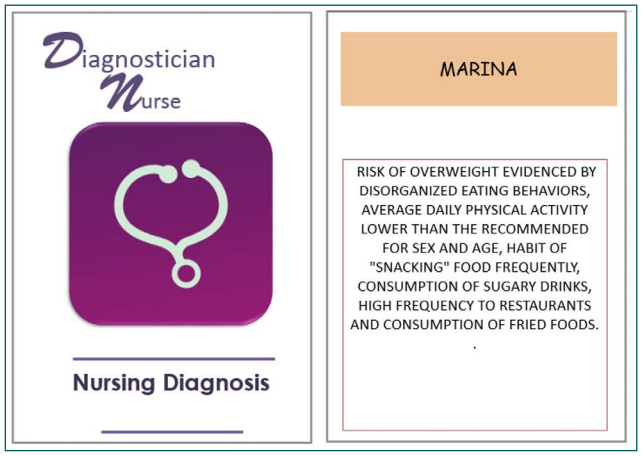

Figure 4. Double-sided layout of "*Enfermeiro Diagnosticador*" nursing diagnosis

tion to a list of clues numbered one through eight. These include statements of patients that will need to be interpreted by students to identify diagnostic indicators, according to the steps of diagnostic reasoning proposed by Gordon.[15]

Thus, another card that makes up the game is the clue card (Figure 3). Each participant will receive clue cards at the beginning of the game, each of which will have a diagnostic indicator. The clue cards will help the diagnostician nurse to advance on the board, and all together will solve the nursing diagnosis for that case.

There are also nursing diagnosis cards (Figure 4), containing the correct case diagnosis. This card will be placed on the board under the clinical case to which it belongs and will be revealed at the end of the case solution, comparing the answers of diagnostician nurses to the correct answer. From the game's final proposal and pilot test application for improvement, the experiment was carried out.

The tutor started the game by randomly dividing the 11 participants into five groups. The rules have been read and explained. Each group chose a peg to represent it on the board and received a NANDA-I version 2018-2020 book to support diagnostic inference. The result of the dice directed the game indicating the sequence of groups. The 25 clue cards (referring to five diagnostic indicators for each of the five diagnoses that made up the game) were shuffled by the tutor and randomly distributed among the groups.

Thus, the first case began. The tutor read the description of case one covered in the case card. The first group drew on the dice the number of spaces

Table 2. "*Enfermeiro Diagnosticador*" effectiveness comparing the pre- and post-test moments

Clinical case	Pre-test		Post-test		p-value*
	Hit n(%)	Miss n(%)	Hit n(%)	Miss n(%)	
Clinical case 1 diagnostic title	2(18.2)	9(81.8)	10(90.9)	1(9.1)	0.008
Diagnostic indicator 1	2(18.2)	9(81.8)	9(81.8)	2(18.2)	0.016
Diagnostic indicator 2	2(18.2)	9(81.8)	9(81.8)	2(18.2)	0.016
Diagnostic indicator 3	2(18.2)	9(81.8)	7(63.6)	4(36.4)	0.125
Diagnostic indicator 4	2(18.2)	9(81.8)	6(54.5)	5(45.5)	0.125
Diagnostic indicator 5	2(18.2)	9(81.8)	5(45.5)	6(54.5)	0.453
Linking words	0(0.0)	11(100.0)	8(72.7)	3(27.3)	-
Clinical case 2 diagnostic title	1(9.1)	10(90.9)	9(81.8)	2(18.2)	0.008
Diagnostic indicator 1	1(9.1)	10(90.9)	5(45.5)	6(54.5)	0.219
Diagnostic indicator 2	0(0.0)	11(100.0)	7(63.6)	4(36.4)	-
Diagnostic indicator 3	1(9.1)	10(90.9)	7(63.6)	4(36.4)	0.031
Diagnostic indicator 4	1(9.1)	10(90.9)	5(45.5)	6(54.5)	0.219
Diagnostic indicator 5	0(0.0)	11(100.0)	7(63.6)	4(36.4)	-
Linking words	0(0.0)	11(100.0)	2(18.2)	9(81.8)	-

ND – nursing diagnosis; *McNemar test; - Does not generate 2x2 table, making it impossible to compare means

to advance and chose a number from one to eight. The tutor read the chosen clue. After reading, participants of the five groups interpreted this one for scientific language and that group that had the clue card in hand (defining characteristics or related/risk factors) made it available under the board and advanced one square.

Thus, the five clues for this case were collected and interpreted, which were grouped by the groups for diagnostic inference based on NANDA-I. Teamwork between the groups is essential, in which each group should highlight the clinical indicators it has from the clues presented by the tutor so that they can be grouped together.

When walking through the squares, the group that first arrived at the case space exposed their diagnostic hypothesis, which was confirmed by reading the nursing diagnosis card by the tutor. The same is true for the next cases. The group of diagnostician nurses who solved the most clinical cases won the game.

Thus, "*Enfermeiro Diagnosticador*" had the participation of 11 students. The mean age was 23.9 years, with a predominance of females (90.9%). Regarding educational characterization, 63.6% completed high school in public schools, 72.7% had no previous training in the health area and only 18.1% had a professional activity in nursing.

Table 2 presents the performance comparison regarding students' diagnostic reasoning before and after applying the "*Enfermeiro Diagnosticador*".

Thus, after applying the board game about diagnostic reasoning in nursing, it was possible to compare students' performance. The correct diagnostic inference showed a statistically significant difference in the resolution of the first (p=0.008) and second (p=0.008) diagnoses, when comparing the pre- and post-test moments. The correct writing of the diagnosis, using its connectors, was presented as relevant at the post-test moment, since the error was unanimous in the pre-test moment.

Moreover, five diagnostic indicators were statistically significant, confirming the difference in the pre and post-test moments. All assessed items showed improvement in the game post-application moment.

Discussion

The results obtained show the "*Enfermeiro Diagnosticador*" effectiveness in undergraduate nursing students' diagnostic reasoning.

This finding corroborates the literature on active methodologies to construct knowledge, given that they bring a critical-reflexive character that encourages individuals' involvement in the learning process.[19] Educational games allow assimilation and accommodation of content to occur. Thus, the subject who participates in its application needs to use critical thinking skills, which are fundamental in diagnostic reasoning in nursing.[20]

The limitations involving traditional teaching with regard to health education, especially for the ability of diagnostic reasoning in nursing, emerge from the results obtained in the pre-test moment of this study. This data corroborates the literature by expressing the different performance of groups of students who experienced traditional teaching when compared to those who made use of active methodologies in their training process, to reach diagnostic reasoning.[3]

The use of games in the learning process presents itself as an opportunity to encourage students to construct knowledge, with professors being an intermediary, moving away from the traditionalist figure of holder of knowledge, and creating a healthy space for constructive discussions.[21]

A study points to the expressive growth of serious games for health education in the last decade, in which 60% of the literature was developed in the last five years.[22] The technological revolution experienced in higher education allowed the creation of technological tools capable of modifying the teaching-learning process, providing centrality to students in this process as well as bringing them closer to the reality in which that knowledge will be applied.

The game characteristics in nursing are: feeling of accomplishment from an objective achieved during the game; competitiveness, which encourages involvement with the proposed activity; control of students in the conduct of their learning with the desire to achieve the outlined objective; and curiosity, making students seek information to reach the objectives.[22] Such characteristics emerge in the proposed board game, from the results obtained in the post-test moment, in which the learning objectives were achieved.

The data obtained after the "*Enfermeiro Diagnosticador*" application show a significant advance, with more successes in diagnosis inference and correct writing.

The literature does not present consistent results regarding the creation and application of board games in teaching diagnostic reasoning in nursing. However, a study involving the application of serious games in nursing has its effectiveness proven from post-test successes, corroborating the results obtained in the present study.[23]

Furthermore, a study points out that the scenario for the applicability of active methodologies still faces problems in higher education institutions (HEIs) that offer the nursing course, from obstacles such as lack of suitable preparation of HEIs and deficit in the qualification of professors to use them.[24]

In this context, the proposed board game stands out, since it stands out as a strategy of low cost and easy replication, from the reproduction of cards, rules and board. These characteristics make the strategy comprehensive for the different realities of nursing training, contributing to an innovative and encouraging education, with a view to achieving qualified care.

The study limitations are related to its application in a single teaching center as well as the assessment of its results in just one moment. Thus, further studies are suggested to compare these results with different educational institutions and to carry out a medium and long-term monitoring of the performance of students who played "*Enfermeiro Diagnosticador*".

Conclusion

"*Enfermeiro Diagnosticador*" is effective to promote nursing students' diagnostic reasoning, with emphasis on the identification of diagnostic title, diagnostic indicators as well as its formulation from the connectors correctly used. Thus, the aim is to advance in the state of the art with regard to educational games of low cost and easy access to support diagnostic reasoning in nursing, thus achieving nursing training that allows developing skills capable of effective safe care and positive health outcomes as well as strengthening nursing as a science.

Collaborations

Tinôco JDS, Silva LSD, Medeiros TM, Grande MEG, Guedes MLA, Fernandes MICD and Lira ALBC contributed to study design, data analysis and interpretation, article writing, relevant critical

review of intellectual content and approval of the final version to be published.

References

1. Garcia TR, Nóbrega MM. Processo de enfermagem: da teoria à prática assistencial e de pesquisa. Esc Anna Nery. 2009;13(1):188-93.
2. Mattei AP. Aplicabilidade do model developing nurses' thinking para o desenvolvimento do raciocínio clínico em graduandos de enfermagem [tese]. Curitiba: Universidade Federal do Paraná; 2017. 158 p.
3. Tinôco JD, Cossi MS, Fernandes MI, Paiva AC, Lopes MV, Lira AL. Effect of educational intervention on clinical reasoning skills in nursing: a quasi-experimental study. Nurse Educ Today. 2021;105:105027.
4. Wong SH, Kowitlawakul Y. Exploring perceptions and barriers in developing critical thinking and clinical reasoning of nursing students: a qualitative study. Nurse Educ Today. 2020;95:104600.
5. Baraki Z, Girmay F, Kidanu K, Gerensea H, Gezehgne D, Teklay H. A cross sectional study on nursing process implementation and associated factors among nurses working in selected hospitals of Central and Northwest zones, Tigray Region, Ethiopia. BMC Nurs. 2017;16:54.
6. Abebe N, Abera H, Ayanna M. The implementation of nursing process and associated factors among nurses working in Debremarkos and Finoteselam hospitals, Northwest Ethiopia, 2013. J Nurs Care. 2014;3(2):1-7.
7. Sayadi N, Rokhafroz D. Nursing students' perspectives on mobile software in the nursing process for bedside use. Iran J Med Educ. 2013;12(12):975-81.
8. Lee TT. Nursing diagnoses: factors affecting their use in charting standardized care plans. J Clin Nurs. 2005;14(5):640-7.
9. Sarhangi F, Masoumeh M, Abas E, Seyed MM, Azad R. Comparing the effect of the luctere and the mapping of concepts based on learning at levels of cognitive learning. Iran J Crit Care Nurs. 2010;3(1):1–5.
10. Domingues AN, Guimarães AC, Silva AF, Esteves JG, Lotufo ML, Santiago DL, et al. Desenvolvimento de jogo educativo sobre segurança do paciente para ensino profissionalizante de enfermagem. In: Anais SIED:EnPED de 15 a 26 de setembro 2014. São Paulo: Universidade Federal de São Carlos; 2014 [citado 2021 Jun 20]. Disponível em: http://www.sied-enped2014.ead.ufscar.br/ojs/index.php/2014/article/view/609
11. Lopes RO, Primo CC, Martins JS, Campos JF, Barbosa GS, Peixoto MA, et al. T-NDX Diagram: Educational Technology Used to Teach Diagnostic Reasoning Based on Nursing Theories. Int J Nurs Knowl. 2020;31(2):94-100.
12. Harmon MM, Thompson C. Clinical reasoning in pre-licensure nursing students. Teach Learn Nurs. 2015;10(2):63-70.
13. Collins A. Effect of continuing nursing education on nurses' attitude toward and accuracy of nursing diagnosis. Int J Nurs Knowl. 2013;24(3):122-8.
14. Reed JM. Gaming in nursing education: recent trends and future paths. J Nurs Educ. 2020;59(7):375–381.
15. Gordon M. Nursing diagnoses: process and application. 3rd ed. St. Louis: Mosby; 1994. 421 p.
16. Lunney M. Pensamento crítico para o alcance de resultados positivos em saúde: análise e estudos de caso em enfermagem. Porto Alegre: Artmed; 2011. 353 p.
17. Herdman TH, Kamitsuru S. NANDA International Nursing Diagnosis: Definitions & Classifications, 2018-2020. Porto Alegre: Artmed; 2018. 568 p.
18. Lopes MV, Silva VM, Araújo TL. Validação de diagnósticos de enfermagem: desafios e alternativas. Rev Bras Enferm. 2013;66(5):649-55.
19. Macedo KD, Acosta BS, Silva EB, Souza NS, Beck CL, Silva KK. Active learning methodologies: possible paths to innovation in health teaching. Esc Anna Nery. 2018;22(3):e20170435.
20. Oermann MH, Heinrich KT. Annual review of nursing education: strategies for teaching, assessment, and program planning. 3rd ed. Nova York: Springer Publishing Company; 2005. 440 p.
21. Gurgel SS, Taveira GP, Matias EO, Pinheiro PN, Vieira NF, Lima FE. Educational games: didactic resources utilized at teaching health education classes. Rev Min Enferm. 2017;21:e-1016.
22. Maheu-Cadotte A, Cossette S, Dubé V, Fontaine G, Deschênes MF, Lapierre A, et al. Differentiating the design principles of virtual simulations and serious games to enhance nurses' clinical reasoning. Clin Simul Nurs. 2020;49:19-23.
23. Cruz JR, Gonçalves LS, Giacomo AP. Agile scrum methodology: implementation by the nurse in an educational game on safe medication management. Rev Gaúcha Enferm. 2019;40(esp)20180302.
24. Weber AP, Firmini F, Weber LC. Metodologias ativas no processo de ensino da enfermagem: revisão integrativa. Rev Saúde Viva Multidisciplinar AJES. 2019;2(2):82-114. Review.