



# Evaluation of the effectiveness of the serious game aleitagame as an educational resource in teaching about mammillary injuries<sup>a</sup>

*Avaliação da efetividade do jogo sério aleitagame como recurso educacional no ensino sobre lesões mamilares*

*Evaluación de la efectividad del juego serio aleitagame como recurso educativo en la enseñanza de las lesiones en los pezones*

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## ABSTRACT

**Objective:** to evaluate the effectiveness of an educational intervention using the serious game AleitaGame as an educational resource in teaching about mammillary injuries. **Method:** a quasi-experimental, single group, before and after, non-randomized study, developed between August and October 2021. The intervention was carried out with 43 professionals working in a hospital in Rio Grande do Norte. Data were analyzed using descriptive and inferential statistics. **Results:** the educational resource had a positive effect, with a significant increase in the knowledge of the participants of the educational intervention ( $p < 0.05$ ). Regarding the evaluation of participants' satisfaction about AleitaGame as an educational resource, most participants considered all items in the "content", "language", "organization and layout", "motivation and learning" categories to be excellent. **Conclusion and implications for practice:** the results of the study are inviting criteria for professors in the area to start incorporating AleitaGame in their classrooms, as well as for using the resource as a strategy for the continuing education of professionals in health services. The serious game is available on the link: <https://aleitagame.github.io/>.

**Keywords:** Breastfeeding; Continuing Education; Educational Technology; Teaching Materials; Knowledge.

## RESUMO

**Objetivo:** avaliar a efetividade de intervenção educativa utilizando o jogo sério AleitaGame como recurso educacional no ensino sobre lesões mamilares. **Método:** estudo quase experimental, do tipo grupo único, antes e depois, não randomizado, desenvolvido entre agosto e outubro de 2021. A intervenção foi realizada com 43 profissionais atuantes em um hospital do Rio Grande do Norte. Os dados foram analisados a partir de estatística descritiva e inferencial. **Resultados:** o recurso educacional apresentou efeito positivo, com aumento significativo no conhecimento dos participantes da intervenção educativa ( $p < 0,05$ ). No que concerne à avaliação da satisfação dos participantes quanto ao AleitaGame como recurso educativo, a maioria dos participantes consideraram ótimos todos os itens das categorias "conteúdo", "linguagem", "organização e layout", "motivação e aprendizagem". **Conclusão e implicações para a prática:** os resultados do estudo são critérios convidativos para docentes da área passarem a incorporar o AleitaGame em suas salas de aula, bem como para utilização do recurso como estratégia para educação permanente dos profissionais nos serviços de saúde. O jogo sério está disponível através do link: <https://aleitagame.github.io/>.

**Palavras-chave:** Aleitamento Materno; Educação Continuada; Tecnologia Educacional; Materiais de Ensino; Conhecimento.

## RESUMEN

**Objetivo:** evaluar la efectividad de una intervención educativa utilizando el juego serio AleitaGame como recurso educativo en la enseñanza de las lesiones en los pezones. **Método:** estudio cuasi-experimental, del tipo grupo único, antes y después, no aleatorizado, desarrollado entre agosto y octubre de 2021. La intervención fue realizada con 43 profesionales que actúan en un hospital de Rio Grande do Norte. Los datos se analizaron mediante estadística descriptiva e inferencial. **Resultados:** el recurso educativo tuvo un efecto positivo, con un aumento significativo en el conocimiento de los participantes de la intervención educativa ( $p < 0,05$ ). En cuanto a la evaluación de la satisfacción de los participantes con AleitaGame como recurso educativo, la mayoría consideró excelentes todos los ítems en las categorías "contenido", "lenguaje", "organización y diseño", "motivación y aprendizaje". **Conclusión e implicaciones para la práctica:** los resultados del estudio son criterios atractivos para que los profesores del área pasen a incorporar el AleitaGame en sus clases, así como a utilizar el recurso como estrategia para la formación continua de los profesionales de los servicios de salud. El juego serio está disponible a través del link: <https://aleitagame.github.io/>.

**Palabras clave:** Lactancia Materna; Educación Permanente; Tecnología Educacional; Materiales de Enseñanza; Conocimiento.

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## INTRODUCTION

Defined as “the foundation of life”, breastfeeding provides the child with the best possible nutrition, in addition to providing better physical and mental health throughout life. There are, in the literature, descriptions of evidence of the positive effects of breastfeeding on children’s health in the short term, such as the reduction of mortality and morbidity related to diarrhea and respiratory infections, as well as in the long term, in the prevention of overweight/obesity, type 2 diabetes, type 1 diabetes and leukemia.<sup>1</sup>

In order to strengthen it within the scope of health services, in 1991 the Baby-Friendly Hospital Initiative was created by the World Health Organization (WHO) and the United Nations International Children’s Emergency Fund (UNICEF). Among the various strategies proposed, step 2 stands out for the success of breastfeeding (BF), which aims to train the entire health care team in the practices necessary for the implementation of the BF promotion policy in accredited hospitals.<sup>2</sup>

There are many teaching demands in this area to encompass the complexity of the subject. Thus, the training is aimed at improving the knowledge of the professionals of the multidisciplinary team about breastfeeding in a context in which mothers may have numerous difficulties and at different times. In this case, the maximum number of professionals trained to deal with clinical management in BF favors the possibility of solving these situations and increases the chances of establishing and/or maintaining it exclusively, as recommended by the WHO, which proposes as a goal for 2030 a prevalence of at least 70% of children under 6 months of age being exclusively breastfed.<sup>3</sup>

Among the reasons given for not breastfeeding, there are problems in the breast, such as painful nipples, flat or inverted nipples, nipple fissure, breast engorgement, obstructed ducts and mastitis.<sup>4</sup> Mammillary trauma is defined as a change in the normal anatomy of the mammillary skin, such as the presence of a primary lesion caused by a change in color, thickness or liquid content, and not only as a break in the skin.<sup>5</sup>

Some national studies that evaluated the knowledge of health professionals about breastfeeding concluded that they have a good general knowledge of the topic. However, within this evaluation perspective, little is portrayed on the specificity required in the care of nipple-areolar lesions, which deserve special attention in promoting the continuity of BF, especially the exclusive one up to six months.<sup>6,7</sup>

Thus, the implementation of an educational intervention focused on professional training becomes relevant. The use of active methodologies and educational technologies can make this process more attractive and dynamic, with the use of a serious game being the teaching material used to promote knowledge on the subject in this study.

From this perspective, the serious game, entitled AleitaGame, was developed in a Doctoral research in Nursing, with the objective of enabling the game participant to approach real cases related to nipple-areolar injuries in the context of breastfeeding.

AleitaGame is composed of three fictitious professional performance scenarios: hospital ward (rooming-in), basic health unit (clinic) and home visit (baby’s room). In these scenarios, cases of inadequate breastfeeding technique, nipple candidiasis and ankyloglossia, respectively, are studied. Interaction with the game is self-instructional, so that the game participant guides and tests their knowledge in an individualized way. Scoring occurs from their interaction with the game and from hits and misses in the knowledge assessment stages. In addition, in all scenarios, there is an exploration phase aimed at providing information regarding the evaluation and decision-making in the case studied. Finally, for each scenario, support material is available in case the game participant feels the need or is interested in delving into the topic.<sup>8</sup>

The game has a practical pedagogical approach to assess learning, with intervention for theoretical discussion in the care of breastfeeding women who are experiencing complications related to breastfeeding.<sup>8</sup>

The growing integration of technological resources in health education, especially with the emergence of the pandemic, reinforces the importance of innovative resources in the process of continuing education for health professionals.

Hence, the following research question arises: what is the effectiveness of the serious game “AleitaGame” as an educational resource used in the continuing education of health professionals?

Therefore, the objective of this study is to evaluate the effectiveness of an educational intervention using the serious game AleitaGame as an educational resource in teaching about mammillary injuries.

## METHOD

This is a quasi-experimental, single-group, before and after, non-randomized study to assess the effectiveness of a serious game as an educational resource for professionals in the multidisciplinary team and to assess the satisfaction of professionals in relation to the use of the serious game as an educational resource.

The research stems from a master’s dissertation developed within the scope of the Postgraduate Program in Health Education, at the Federal University of Rio Grande do Norte, with defense in the year 2022,<sup>9</sup> which continued the doctoral study in which the game was developed.<sup>8</sup>

The study was carried out in a hospital linked to a Higher Education Institution that is a reference in obstetric and pediatric medium complexity, as well as in intensive and semi-intensive neonatal care and gynecological surgeries in the state of Rio Grande do Norte.

The study population included all professionals involved in the preceptorship of the institution’s Multiprofessional Residency in Maternal and Child Health, totaling 110 people. There was no refusal to participate, but the sampling was for convenience, so that the professionals who were working during the data collection period participated in the research, totaling 43 participants. The invitation to the participants took place within the activities

of *Agosto Dourado* (Golden August, in free translation), month alluding to breastfeeding.

To assess the effectiveness of the game, a pre- and post-test instrument was developed and validated, based on a methodological framework adapted from Pasquali's psychometry (development) and two-step Delphi (validation), with the participation of six judges.<sup>10</sup> The evaluation took place between April and May 2021. The instrument was considered valid, with a Content Validity Coefficient of 0.99.

The game consists of 10 multiple-choice questions, with four alternatives each, divided into four questions about breastfeeding technique, three about fungal infection and three about ankyloglossia.

To assess satisfaction, a structured questionnaire adapted from the Suitability Assessment of Materials (SAM) was used. Composed of 19 questions, the instrument aims to assess satisfaction based on the "content", "language", "organization and layout", "motivation and learning" categories. Each of the instrument's variables is evaluated on a 3-point Likert scale, where: 2-excellent; 1-adequate; 0-not suitable.<sup>11</sup>

Data were collected in person, between August and October 2021, respecting distancing and number of people recommendations. The data collection instrument was made available through a Google Forms link, which was subdivided into the following parts: consent form; participant profile; pre-test; link to AleitaGame; post-test; and satisfaction assessment.

After completing the pre-test, participants viewed the link to access AleitaGame. Before starting to navigate the game, they received guidance from a facilitator and had help to clarify doubts, when requested, with regard to technical aspects of navigation through the game and/or access to the research instruments. The navigation of the game lasted an average of one hour.

The data were organized in an Excel<sup>®</sup> for Windows<sup>®</sup> database and later transported to the Statistical Package for the Social Sciences (SPSS) version 20.0 software, where they were analyzed in two stages. The evaluation of effectiveness was performed by comparing the means of correct answers in the pre- and post-test instruments, using the Wilcoxon test, adopting a statistical significance level of 5% ( $p < 0.05$ ). Satisfaction assessment was performed using simple descriptive statistics, with calculation of number and percentage to assess the percentage of agreement of the subjects regarding the criteria evaluated by the SAM.

The research complied with the ethical and scientific rigors recommended by Resolutions nº 466/12 and 510/2016 of the National Health Council, with approval by the Research Ethics Committee (CEP), with CAAE number: 40424520.7.0000.5292 and Opinion number: 4,462,449/2020, of December 14, 2020.

## RESULTS

A total of 43 professionals participated in the research, divided into eight professional categories (Table 1).

The training time ranged from 0 to 23 years, with a mean of 11.37 (SD=5.572) and the time working in the maternal-infant area ranged from 0 to 25 years, with a mean of 4.65 (SD=4.364).

**Table 1.** Professional categories that participated in the survey. Santa Cruz, Rio Grande do Norte, Brazil, 2021.

CATEGORIES	n (%)
Nurse	18 (41.9%)
Nursing Technician	11 (25.6%)
Psychologist	7 (16.3%)
Physiotherapist	3 (7.0%)
Nutritionist	1 (2.3%)
Dental Surgeon	1 (2.3%)
Speech Therapist	1 (2.3%)
Administrative Assistant	1 (2.3%)

Source: prepared by the authors.

It is noteworthy that the training time referred to the last degree of the professional, which demonstrates that there are professionals who already worked in the maternal and child area before the current degree.

Regarding the degree, five (11.6%) have only a technical level, three (7.0%) have incomplete higher education, seven (16.3%) only have a higher education degree and 28 (65.1%) have postgraduate studies.

As for the sector of activity, seven (14.0%) professionals from the Rooming-in/Surgical Clinic participated, seven (16.3%) from the Neonatal Intensive Care Unit - NICU, six (14.0%) from the COVID-19 Wing, six (14.0%) from the Child Health Care Unit - CHCU, five (11.6%) from the Parturition, Childbirth and Puerperium Sector - PCP, three (7.0%) from the reception and risk classification, three (7.0%) from the Human Milk Collection Post - HMCP, two (4.7%) from the People Development Unit - PDU, two (4.7%) from the Women's Health Care Unit - WHCU, one (2.3%) from Nutrition, one (2.3%) from Dentistry.

With regard to participation in training on breastfeeding, 38 participants (88.4%) answered yes and five (11.6%) answered no.

Twenty-two (51.2%) participated in training on mammillary injuries and 21 (48.8%) did not participate. Although more than half of the participants had already participated in training on mammillary injuries, most responded that they had little knowledge on the subject (Figure 1).

When asked if they consider knowledge about mammillary injuries care important for professional practice, 42 (97.7%) respondents answered yes and one (2.3%) answered no.

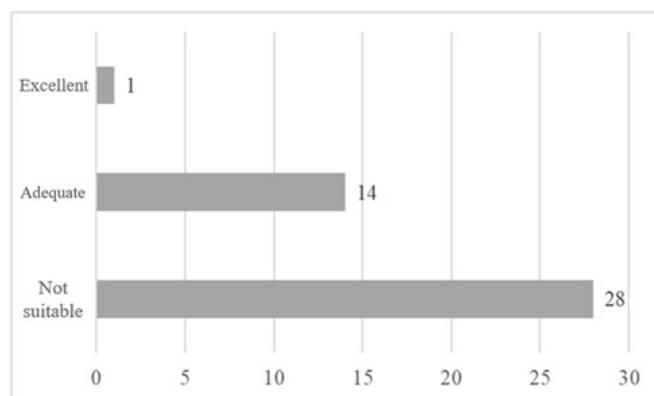
Regarding the assessment of knowledge by comparing the scores obtained in the pre- and post-test, the descriptive analysis showed an increase in the percentage of correct answers for questions 3, 5, 7, 8 and 9 and a reduction in correct answers for questions 2, 4 and 10. Questions 1 and 6 had no change in the number of correct answers between the pre and post-test (Table 2).

With regard to the assessment of the effectiveness of AleitaGame, the results presented show statistically significant differences (Table 3). Thus, it can be said that the educational

**Table 2.** Pre and post-test correct answers. Santa Cruz, Rio Grande do Norte, Brazil, 2021.

Item	Pre-test successes		Post-test successes	
	n	%	n	%
Question 1 - Relationship between breastfeeding technique and mammillary trauma	33	76.7	33	76.6
Question 2 - Correct attachment of the baby to the mother’s breast	31	72.1	29	67.4
Question 3 - Mammillary trauma prevention measure	42	97.7	43	100.0
Question 4 - Breastfeeding technique	39	90.7	38	88.4
Question 5 – Diagnosis of mammillary injury	30	69.8	38	88.4
Question 6 - Guidance for breast candidiasis	34	79.1	34	79.1
Question 7 - Signs and symptoms of breast candidiasis	34	79.1	40	93.0
Question 8 - Purpose of the lingual frenulum assessment	31	72.1	35	81.4
Question 9 - Difficulties in breastfeeding due to ankyloglossia	37	86.0	40	93.0
Question 10 - Phases of the Tongue Test protocol	33	76.7	23	53.5

Source: prepared by the authors.



**Figure 1.** Assessment of self-knowledge about mammillary injuries, in absolute numbers, 2022.

Source: prepared by the authors.

resource had a positive effect, with a significant increase in the knowledge of the participants of the educational intervention.

Regarding the evaluation of the participants’ satisfaction with AleitaGame as an educational resource, the general impression of the game was evaluated as excellent, since at least 86% of the participants considered all items in the “content”, “language”, “organization and layout”, “motivation and learning” categories to be excellent. (Table 4).

None of the items in the aforementioned categories was assessed as not adequate. In the category related to “illustrations and typography”, 83.3% rated the item that deals with captions in the illustrations as excellent and 2.3% considered the item not suitable. Items 2 (The content meets the purpose of the game) and 19 (The game brought important knowledge that could be applied in practice) were the ones with the highest percentage

**Table 3.** Average of correct answers in the pre and post-test. Santa Cruz, Rio Grande do Norte, Brazil, 2021.

	Pre-Test Grade	Pre-Test Grade	p*
Min-Max	3-10	3-10	-
Average (SD)	7,63 (1.89)	8,23 (1.81)	<0,05

Source: prepared by the authors.

\* Wilcoxon Test

of maximum evaluation, both with 97.7%. Table 4 presents the evaluation results for all categories.

In addition, participants reported access to new and relevant information for their professional practice.

## DISCUSSION

The profile of the participants corroborates the distribution of the quantity, by category, of the health institutions. However, there was an absence of the medical category, which is a very important component in the promotion of BF in institutions, as this profession is the one that most frequently assists in childbirth, as demonstrated in the study “Born in Brazil: National Survey on Labor and Childbirth”.<sup>12</sup>

Most of the participants are nurses and nursing technicians, in line with research data carried out by the Oswaldo Cruz Foundation (FIOCRUZ), which presents Nursing as the largest professional category working in the field of health in Brazil.<sup>13</sup>

Regarding the effectiveness of AleitaGame, a positive result was observed in the matter of knowledge assessment after educational intervention, thus corroborating the objective of this

**Table 4.** AleitaGame satisfaction rating. Santa Cruz, Rio Grande do Norte, Brazil, 2021.

Criterion	1 (Not suitable)		2 (Adequate)		3 (Excellent)	
	n	%	n	%	n	%
SAM 1 - The purpose of the game is evident	-	-	5	11.6	38	88.4
SAM 2 - Content serves the purpose of the game	-	-	4	9.3	39	90.7
SAM 3 - Content is relevant to healthcare professionals	-	-	1	2.3	42	97.7
SAM 4 - Text is easily understandable	-	-	5	11.6	38	88.4
SAM 5 - The writing is suitable for the target audience	-	-	3	7.0	40	93.0
SAM 6 - There is clarity in writing	-	-	5	11.6	38	88.4
SAM 7 - The game is interesting and attractive	-	-	6	14.0	37	86.0
SAM 8 - The content is clear	-	-	5	11.6	38	88.4
SAM 9 - The structure of the game is adequate	-	-	5	11.6	38	88.4
SAM 10 - Font and text size favor reading	-	-	3	7.0	40	93.0
SAM 11 - The illustrations are consistent with the content	-	-	3	7.0	40	93.0
SAM 12 - The illustrations are relevant and attractive	-	-	3	7.0	40	93.0
SAM 13 - The illustrations have captions	1	2,3	6	14.0	36	83.7
SAM 14 - Graphic elements complement the text	-	-	3	7.0	40	93.0
SAM 15 - The student is motivated to continue the game	-	-	4	9.3	39	90.7
SAM 16 - Did you feel motivated to access the entire game	-	-	6	14.0	37	86.0
SAM 17 - The game is relevant to your practice as a preceptor	-	-	2	4.7	41	95.3
SAM 18 - The game brought you information previously unknown to you	-	-	2	4.7	41	95.3
SAM 19 - The game brought important knowledge that could be applied in practice	-	-	1	2.3	42	97.7

Source: prepared by the authors.

tool. Serious Games is the name for the category of games that have learning as their main objective, through their dynamic, responsive and visual nature, stimulating motivation, strong user involvement and meaningful learning. Learning from experience is the dominant pedagogical paradigm in serious game design. It is learning through active, self-directed exploration rather than learning from instruction.<sup>14</sup>

The three AleitaGame scenarios represent some of the environments of the complex Health Care Network, which provide the opportunity to offer care for mamillary injuries. Thus, the hospital, basic health unit and home scenarios demonstrate the different contexts in which this complication can arise at different levels of health care, as well as representing three different complications, confirming the importance and scope of the topic.

In this context, it is known that learning is a complex phenomenon. Thus, the following are some fundamental aspects for it to occur successfully: the creation of challenges; activities; games that mobilize skills; that request relevant information; that offer exciting rewards; that combine personal journeys with meaningful participation in groups; that are part of adaptive platforms; that recognize each student and at the same time learn from the interaction.<sup>15-17</sup>

The literature shows that serious games in the health area were designed for three target audiences: health service providers; patients; and public users. Examples of topics studied in the first category are: knowledge of diseases; general health; health service management; medicines; mental health; nutrition; pedagogical content; sexuality; among others. Other examples that can express the second category were games aimed at behavioral and emotional skills, clinical competence, cognition, decision-making, language, memory, reading and writing, self-control, social and others.<sup>14</sup>

After carrying out this study, AleitaGame advances in its development in terms of evaluation and validation, the latter not yet carried out with the target audience in the game, bringing it closer to its completion and the feasibility of educational software as an educational resource in the training of health professionals.<sup>16</sup>

In addition, it contributes to the advancement of science, both in the area of education and in the training of professionals in the field of health and health education, considering its differentiated conceptions. Regarding the pedagogical objective of a serious game, with AleitaGame, there is the possibility of approximation between theory and practice in an educational resource that favors active and meaningful learning through the offer of multiple

didactic resources and the approach of the student to a problem close to the reality.<sup>17-21</sup>

Finally, the evidence of knowledge improvement, as well as the positive results regarding the evaluation of the educational resource itself, are inviting criteria for teachers in this area to start incorporating AleitaGame in their classrooms, as well as for using the resource as a strategy for continuing education of professionals in health services. The serious game is available on the link: <<https://aleitagame.github.io/>>.

## CONCLUSION AND IMPLICATIONS FOR PRACTICE

The statistical analysis of the data showed a gain in knowledge after the educational intervention. Therefore, AleitaGame proved to be an effective educational resource to improve the knowledge of professionals about mammary injuries resulting from breastfeeding, in addition to presenting itself as an innovative educational tool, which follows the paradigm shift in health education.

Some limitations were found in the course of the research, such as the moments of aggravation of the pandemic, which prevented or limited the performing of face-to-face activities. Another challenge encountered was the logistics to make computers available, since browsing the game is not well used on mobile devices, such as smartphones and tablets.

As methodological limitations, we highlight the lack of a control group, the type and size of the sample, which make it difficult to generalize the results to other municipalities in the state of Rio Grande do Norte and Brazil, in addition to the possibility of bias related to the memory of the participants due to the short time interval between pre-test, intervention and post-test.

It is expected that continuing education activities increasingly incorporate innovative teaching tools, in addition to other actions to promote breastfeeding that can generate positive effects on the quality of care and service indicators. The adoption of active methodologies in the different teaching scenarios provides integration between theory and practice and tends to qualify the teaching-learning process in the service both for professionals and for undergraduate and graduate students inserted in these scenarios.

The accomplishment of the study points to challenges related to changes in the practices of continuing education in health services, as well as to the demand of professionals for new teaching methods that stimulate critical and reflective thinking.

Finally, it is important to carry out other studies related to the evaluation of educational interventions in the continuing education of health professionals in order to qualify the teaching-learning process of workers and the consequent qualification of care.

## AUTHOR'S CONTRIBUTION

Study design. Francisca das Chagas Soares Pereira. Pétala Tuani Candido de Oliveira Salvador. Lays Pinheiro de Medeiros.

Data collection or production. Francisca das Chagas Soares Pereira. Pétala Tuani Candido de Oliveira Salvador.

Data analysis. Francisca das Chagas Soares Pereira. Pétala Tuani Candido de Oliveira Salvador.

Interpretation of results. Francisca das Chagas Soares Pereira. Lays Pinheiro de Medeiros. Pétala Tuani Candido de Oliveira Salvador.

Writing and critical review of the manuscript. Francisca das Chagas Soares Pereira. Lays Pinheiro de Medeiros. Pétala Tuani Candido de Oliveira Salvador.

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Responsibility for all aspects of the content and the integrity of the published article. Francisca das Chagas Soares Pereira. Lays Pinheiro de Medeiros. Pétala Tuani Candido de Oliveira Salvador.

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