Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

https://doi.org/10.23913/ride.v16i32.2883

Scientific articles

Valoración visual en un entorno industrial: una experiencia formativa en enfermería

Visual assessment in an industrial environment: a training experience in nursing

Avaliação visual em ambiente industrial: uma experiência de formação em enfermagem

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Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Resumen

Este estudio describe una intervención educativa desarrollada en un entorno industrial por cinco estudiantes de la Licenciatura en Enfermería de una universidad pública de San Luis Potosí, en la ciudad de Matehuala, durante el periodo 2023-2024. Se implementó un estudio de investigación-acción con enfoque participativo, cuyo propósito fue fortalecer la competencia en valoración visual como habilidad clínica mediante un programa de tamizaje ocular orientado a la detección temprana de alteraciones y a la promoción de la salud visual. El diseño se estructuró en tres fases: (1) diagnóstico inicial y capacitación estudiantil; (2) aplicación de pruebas de tamizaje visual en trabajadores; y (3) análisis cualitativo de la experiencia formativa.

La capacitación incluyó anatomía ocular, técnicas de exploración, manejo de instrumentos, interpretación de hallazgos y criterios de derivación, apoyada en dos cuestionarios aplicados mediante la plataforma Microsoft Forms. Los estudiantes realizaron pruebas de tamizaje con Cartas de Snellen, campimetría y examen de fondo de ojo en casos seleccionados, además de una historia clínica estructurada.

Se evaluaron 104 trabajadores, de los cuales el 66,35 % pertenecía a áreas de producción, con una edad media de 31,5 años; 22 presentaban enfermedades crónicas degenerativas. El 50 % reportó problemas visuales y el 76 % síntomas como lagrimeo, ojo seco o prurito; solo 18 utilizaban lentes correctivos. Asimismo, se identificaron factores ergonómicos relacionados con la iluminación, la postura y la exposición a pantallas.

Los resultados evidenciaron necesidades clínicas en la población trabajadora y áreas de mejora en la formación profesional. La intervención fortaleció el juicio clínico y las competencias de observación de los estudiantes y fundamenta la incorporación sistemática y temprana de contenidos oftálmicos y práctica situada en el currículo de Enfermería.

Palabras clave: Competencia clínica, Estudiantes de Enfermería, Salud laboral, Valoración visual

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Abstract

This study described an educational intervention developed in an industrial setting by five undergraduate nursing students from a public university in San Luis Potosí, in the city of Matehuala, during the 2023–2024 period. Action research using a participatory approach was implemented to strengthen clinical competence in visual assessment through an ocular screening program focused on the early detection of visual alterations and the promotion of eye health. The design was structured in three phases: (1) initial diagnosis and student training; (2) application of visual screening tests among workers; and (3) qualitative analysis of the formative experience.

Training included ocular anatomy, examination techniques, instrument handling, interpretation of findings, and referral criteria, supported by two questionnaires administered via Microsoft Forms. Students conducted screening tests using Snellen charts, perimetry, and fundus examination in selected cases, along with a structured clinical history.

A total of 104 workers were assessed, 66.35% from production areas, with a mean age of 31.5 years; 22 had chronic degenerative diseases. Fifty percent reported visual problems and 76% experienced symptoms such as tearing, dry eye, or itching; only 18 used corrective lenses. Ergonomic factors related to lighting, posture, and screen exposure were also identified.

The results revealed clinical needs within the working population and areas for improvement in professional training. The intervention strengthened students' clinical judgment and observational competencies and supported the systematic and early integration of ophthalmic content and situated practice into the nursing curriculum.

Keywords: Clinical Competence, Nursing Students, Occupational Health, Visual Assessment

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Resumo

Este estudo descreveu uma intervenção educativa desenvolvida em um ambiente industrial por cinco estudantes do curso de Enfermagem de uma universidade pública de San Luis Potosí, na cidade de Matehuala, durante o período de 2023-2024. Implementou-se Pesquisa-ação com abordagem participativa, cujo objetivo foi fortalecer a competência em avaliação visual como habilidade clínica por meio de um programa de triagem ocular voltado à detecção precoce de alterações e à promoção da saúde ocular. O desenho foi estruturado em três fases: (1) diagnóstico inicial e capacitação dos estudantes; (2) aplicação de testes de triagem visual nos trabalhadores; e (3) análise qualitativa da experiência formativa.

A capacitação incluiu anatomia ocular, técnicas de exame, manejo de instrumentos, interpretação de achados e critérios de encaminhamento, apoiada em dois questionários aplicados por meio da plataforma Microsoft Forms. Os estudantes realizaram testes de triagem utilizando tabelas de Snellen, campimetria e exame de fundo de olho em casos selecionados, além de anamnese clínica estruturada.

Foram avaliados 104 trabalhadores, dos quais 66,35% atuavam em áreas de produção, com idade média de 31,5 anos; 22 apresentavam doenças crônicas degenerativas. Cinquenta por cento relataram problemas visuais e 76% sintomas como lacrimejamento, olho seco ou prurido; apenas 18 utilizavam óculos corretivos. Também foram identificados fatores ergonômicos relacionados à iluminação, à postura e à exposição a telas.

Os resultados evidenciaram necessidades clínicas na população trabalhadora e áreas de aprimoramento na formação profissional. A intervenção fortaleceu o julgamento clínico e as competências de observação dos estudantes e sustentou a integração sistemática e precoce de conteúdos oftalmológicos e prática situada no currículo de Enfermagem.

Palavras-chave: Competência Clínica, Estudantes de Enfermagem, Saúde do Trabalhador, Exame Ocular.

Date Received: October 2025 **Date Accepted:** March 2026

Introduction

Nursing is centered on care, understood as a process that integrates science, technique, and human sensitivity. The training of future professionals requires not only mastery of theoretical models but also experiences that allow them to transfer that knowledge to real-world clinical and community practice settings. This interaction fosters the development of observation, interpretation, and critical thinking skills in relation to factors that influence health (Álvarez, 2022).

One aspect still insufficiently explored in the literature is visual assessment as a diagnostic and reflective skill developed outside the hospital setting. The World Health Organization (WHO), traditionally associated with specialized clinical contexts, is adopting a preventive dimension linked to primary care in community and industrial settings. Within this framework, visual and ocular screening, understood as a strategy for the early detection of alterations amenable to diagnostic evaluation and timely treatment, transcends its instrumental character and becomes a formative experience that integrates clinical judgment, contextual analysis, and evidence-based decision-making (WHO, 2023).

In the hospital setting, several studies have examined the competence of nursing staff in eye health. López Briceño et al. (2021), in a quantitative descriptive study conducted with 36 professionals from an intensive care unit in Mexico, applied a validated questionnaire (Cronbach's alpha = 0.80) to measure the level of knowledge in ophthalmic care. 94.4% presented a low level according to the established scale, with no significant association with academic degree or work experience. Similarly, Lami and Ayed (2023), in a cross-sectional study conducted in West Bank hospitals with 152 nursing professionals, identified limited levels of knowledge (0.7% with a high level) and insufficient practice (25.7% adequate), with knowledge and the existence of institutional protocols being significant predictors of practice ($p < .001$). In Turkey, Gungor et al. (2025), using a cross-sectional descriptive design with 210 nurses from the intensive care unit (ICU) and the Eye Care Clinical Competence Questionnaire, observed low scores in the knowledge dimension, although with favorable attitudes; competence was significantly higher in those with certification and specific training ($p < .05$). In China, Zhang et al. (2025) conducted a multicenter cross-sectional study in 17 hospitals across eight provinces with 1947 participants. Using the Eye Care Competence Index (ECCI), they reported a total mean score of 79.97 ± 11.60; the knowledge dimension obtained the lowest scores, while prior training was positively associated with greater competence in the multivariate analysis. Overall, international hospital evidence consistently

shows training gaps in the cognitive component of eye care and highlights the crucial role of structured training and institutional protocols.

Significant deficiencies have also been documented in primary and community care. In Peru, Almeyda Hernández (2024) conducted a quantitative, relational, non-experimental study at a public university in Ica, using a stratified probability sample of 160 nursing students. A validated and reliable questionnaire revealed a predominance of medium (61%) and low (39%) knowledge about eye health, while eye health care was mostly inadequate (89%). Furthermore, a statistically significant relationship was demonstrated between the level of knowledge and care practices ($r = 0.41$; $p = 0.01$), highlighting the influence of the cognitive component on preventive behavior. In a rural district of South Africa, Flatela and Xulu-Kasaba (2024), through a cross-sectional study of primary care nurses, reported a lack of formal training in 93.5% of cases, low identification rates for cataracts and glaucoma (28% each), and difficulties in measuring visual acuity (94%), in addition to deficiencies in equipment and protocols. Similarly, the scope review by Sharbini et al. (2025) indicates that the literature focuses on specific interventions and advanced roles, with little clarity regarding minimum undergraduate content requirements. Taken together, these findings demonstrate that training gaps are not limited to the hospital setting but rather permeate different levels of care, reinforcing the need to systematically integrate visual assessment and screening into initial nursing education.

Taken together, the reviewed evidence demonstrates that nursing practice requires specific clinical and contextual competencies to identify physical signs and environmental factors that influence visual health and well-being. In the case of vision, this ability becomes especially relevant in the workplace, where lighting, contrast, prolonged exposure, and ergonomic conditions exert particular stress on the ocular system. Within the framework of occupational health in industrial settings, these elements must be incorporated into the analysis and preventive recommendations. Similarly, recent research warns of emerging risks associated with the intensive use of digital screens, which demands new strategies for the prevention and monitoring of visual health (Ramada-Rodilla et al., 2025).

Finally, visual assessment can include a comprehensive clinical evaluation of the functional status of the visual system (Morales León et al., 2022); however, in the context of nursing practice, it is mainly oriented towards the initial detection of alterations, through the measurement of visual acuity and the identification of signs and symptoms that require subsequent specialized evaluation

Despite accumulating evidence of gaps in knowledge and practice regarding eye care in hospital and primary care settings, the literature shows little documentation on the systematic integration of visual assessment and screening as training competencies in industrial contexts. Likewise, studies analyzing these practices from an action-research perspective focused on situated learning in nursing are limited. This absence highlights a gap in professional training that requires contextualized and evaluable pedagogical approaches.

In response to this need, the present study aimed to strengthen the clinical skills of five nursing students from a public university in the state of San Luis Potosí, in the city of Matehuala, during the period 2023-2024, through a training experience in visual assessment and eye screening, with emphasis on the timely detection of alterations and visual prevention.

The experience was developed using a problem-based learning approach, through visual assessments conducted at a company that manufactures plastic sacks in the Potosí highlands. The collaboration between academia and industry served as a bridge between the classroom and the realities of production. Direct contact with the workers allowed the students to identify visual impairments and risk factors associated with working conditions, analyze their possible causes, and formulate improvement proposals aimed at prevention and timely referral.

This intervention strengthened their clinical skills related to the basic assessment of visual function and consolidated their observation, communication, and interdisciplinary teamwork abilities. It also fostered a critical and contextualized perspective on visual health in the workplace, demonstrating how nursing practice can generate concrete interventions in productive environments.

To consolidate this training process, digital tools were incorporated to facilitate systematic reflection on learning. The literature has indicated that resources such as electronic portfolios promote motivation, self-efficacy, and reflective learning (Wei et al., 2025). In line with this perspective, the project included digital recording and self-assessment tools that allowed for critical analysis of clinical performance. Thus, practical experience was accompanied by a reflective process that facilitated the integration of theory and experience, in line with the findings of Najaffard et al. (2024).

In summary, this training experience represents an opportunity to connect visual health theory with the production environment, strengthen observational skills in an authentic context, and generate proposals that integrate visual health, ergonomics, and professional training. Furthermore, it provides empirical evidence on the feasibility of incorporating

visual assessment and screening in industrial settings as a pedagogical strategy in nursing education, helping to address the limited existing documentation on these skills outside the hospital setting.

Materials and methods

This study is framed within a participatory action research approach. According to Baum et al. (2006), participatory action research is a methodology aimed at understanding and improving reality through a collective and self-reflective process that integrates planning, action, and evaluation in successive cycles, promoting the participation of stakeholders and the transformation of practice. In line with this approach, the process was structured around cyclical dynamics aimed at continuous improvement within a real-world intervention context.

In this study, the participatory dimension was manifested in the active involvement of students in identifying needs, implementing visual screening, and critically analyzing the results, fostering situated learning and progressive adjustments in their training practice. The experience was developed during the 2023–2024 academic year with five undergraduate nursing students from a public university in the state of San Luis Potosí, on a campus located in the city of Matehuala. For a better understanding of the process, the methodology is presented in three distinct phases, which addressed the students' training, the diagnostic intervention for the company's staff, and finally, the students' perceptual evaluation of the experience.

First stage: assessment and training of students

The first stage of the methodological process focused on pedagogical aspects and began with a diagnostic assessment designed to identify students' prior knowledge of basic visual function assessment and its applicability in non-hospital settings within their discipline. To this end, two questionnaires were designed and administered using the Microsoft Forms platform, both consisting of closed-ended questions. The first included an identification form and 20 items aimed at exploring knowledge of the anatomy and physiology of the visual system; the second, comprised of 30 items, assessed technical knowledge related to visual screening procedures and reference criteria.

The instruments were developed based on the components of the examination form subsequently used in fieldwork, in order to verify understanding of its use and recording. Consequently, content related to visual acuity measurement using Snellen and Rosenbaum charts, confrontation visual field testing, assessment of pupillary reflexes and eye movements, as well as the recognition of external signs suggestive of impairment and the corresponding referral criteria, were evaluated. Additionally, items were included to explore conceptual knowledge of basic fundus examination without pharmacological mydriasis, understood solely as a preliminary identification procedure. The scope of the instrument was limited to primary examination skills specific to nursing, excluding content related to refraction or specialized diagnostic interventions.

The selection of this content was based on the curriculum framework of the Bachelor of Science in Nursing. In particular, the Anatomy I program for the first semester establishes the following learning outcome:

> *"Identify and describe the main regions of the skull and brain, integrating the sense organs. The student will demonstrate their knowledge of the skull, brain, and sense organs through full identification on mannequins or diagrams created by the student, demonstrating the connection of their knowledge to the subject of Fundamentals of Nursing Care II* ." (Autonomous University of San Luis Potosí, Multidisciplinary Academic Unit Altiplano Region 2020)

In this way, the instrument was aligned with the formal competencies of the curriculum.

To ensure the relevance, clarity, and coherence of the items, the questionnaires underwent a content validation process using the Delphi technique, conducted in two successive rounds. The panel consisted of ten experts selected through purposive sampling, with the following inclusion criteria: a minimum of five years of experience in clinical practice related to visual health or community nursing, occupational health, or participation in higher education teaching activities and/or research experience in the health sciences. The number of experts was considered appropriate according to the methodological literature, which recommends panels of between 7 and 15 participants for content validation studies. In the first round, the experts evaluated each item in terms of clarity, relevance, and coherence using a four-point ordinal scale. The percentage of agreement was calculated for each item, and a minimum consensus level of 80% was established as the acceptance criterion. Items that did not reach this threshold were reformulated based on the qualitative observations

provided by the judges. In the second round, the adjusted items were returned to the panel for further evaluation, achieving an agreement level of over 85% across all items, thus confirming their suitability for diagnostic application. This procedure strengthened the content validity of the instrument and provided a solid methodological basis for measuring the initial level of knowledge.

Based on the results obtained, a 20-hour theoretical-practical training plan was designed and implemented in person, which included sessions on ocular anatomy, basic visual examination techniques, use of instruments, preliminary interpretation of findings and reference criteria. A post-training assessment was then administered to identify the level of learning achieved and reinforce key aspects before the training began with the company's employees.

Second stage: visual assessment of company personnel

The second methodological phase involved an intervention at the maquiladora (assembly plant), where the previously trained students participated in implementing a screening program and basic assessment of visual function for the workforce. The purpose was to identify visual impairments and risk factors associated with the work environment that could affect health and productivity, thus linking academic objectives with the real needs of the industrial context.

The evaluation began with the measurement of visual acuity using Snellen charts to establish a baseline of each participant's central vision. Subsequently, confrontation visual field testing was performed to assess peripheral vision, a relevant aspect in industrial settings where lateral vigilance is a component of workplace safety. Pupillary reflexes and eye movements were also evaluated as part of the primary examination.

In specific cases, particularly in workers with a history of chronic degenerative diseases, basic fundus examination was performed using a direct ophthalmoscope without pharmacological mydriasis, solely for preliminary identification purposes and under professional supervision. This assessment did not constitute a specialized diagnosis, and any findings that warranted it were referred for ophthalmological care.

In addition, structured clinical histories were developed for visual assessment, in which personal and family history, use of corrective lenses, current symptoms, work habits, exposure to artificial lighting, visual fatigue and screen exposure times were recorded.

The information obtained was recorded individually and integrated into a database for statistical analysis using SPSS version 23 software. Descriptive statistics (frequencies, percentages, means) were used to interpret the results, which were organized into tables and graphs. This data allowed for the formulation of preventive recommendations for the company and reinforced the students' clinical learning in a real-world production environment.

The intervention was carried out after obtaining the corresponding authorizations from the educational institution and the company, formalized through official letter No. 10172023. The participating company also provided its consent for the visual screening to be conducted on its premises, with the support of its professional nursing staff. All employees were informed about the objectives, scope, and voluntary nature of the activity and provided their written informed consent before participating. It was ensured at all times that the intervention did not involve physical or psychological risks, as it was limited to basic, non-invasive visual examination procedures, with all cases referred to specialists if necessary. The information collected was handled under criteria of confidentiality and anonymity. No names or personal data that would allow for the direct or indirect identification of the participants were recorded. The results were systematized and analyzed in aggregate, exclusively for academic purposes and to improve preventive measures in the workplace.

Third moment: the perceptual evaluation of the experience

To explore the students' perceptions, a descriptive qualitative approach was used, employing a focus group with the five project participants. The session took place in a classroom at the institution, in a private space that ensured confidentiality, and lasted approximately 90 minutes.

The group was moderated by a member of the teaching-research team who was not directly involved in the students' final academic evaluation, in order to reduce potential social desirability bias. Their role consisted of facilitating the discussion, promoting equitable participation, and exploring the narratives in depth through probing questions, while another team member acted as an observer and assisted with field notes.

A semi-structured, open-ended interview guide was used, designed to ensure comparability among participants without limiting narrative depth. The guide was developed based on: (1) the study objectives and the rationale for the intervention; (2) predefined conceptual categories (teaching methodology, theory-practice link, impact on learning,

academic workload, and professional sufficiency/insufficiency); and (3) iterative review by the teaching-research team to ensure clarity and relevance. Although the guide was not subjected to formal external validation, quality assurance strategies were implemented, such as explicit alignment with the analytical dimensions and the use of prompts ("Can you give an example?"; "What facilitated or hindered that situation?").

The central questions included: (a) general experience during the intervention; (b) relevant learnings and their application in the field; (c) articulation between theory and practice; (d) difficulties faced; and (e) proposals for improvement.

The sessions were audio-recorded with prior informed consent and subsequently transcribed verbatim. The unit of analysis was defined as the segment of meaning, understood as discursive fragments with thematic coherence linked to the study's objectives.

The analysis was conducted using a thematic analysis approach, following the phases proposed by Ahmed et al. (2025): (1) data familiarization, (2) initial code generation, (3) theme search, (4) theme review, (5) theme definition and naming, and (6) report preparation. Coding was performed independently by two members of the research team; subsequently, the results were compared and discussed until an interpretive consensus was reached, strengthening analytical consistency. Since the focus group included all participants in the intervention (N = 5), theoretical saturation in the classical sense of sample expansion was not sought. However, internal saturation was considered to have been reached when iterative analysis did not produce new relevant dimensions within the corpus. Qualitative rigor criteria were met, including credibility (analyst triangulation), conformability (systematic recording of analytical decisions), and interpretive coherence between the identified themes and the selected textual quotations.

Results of the first stage

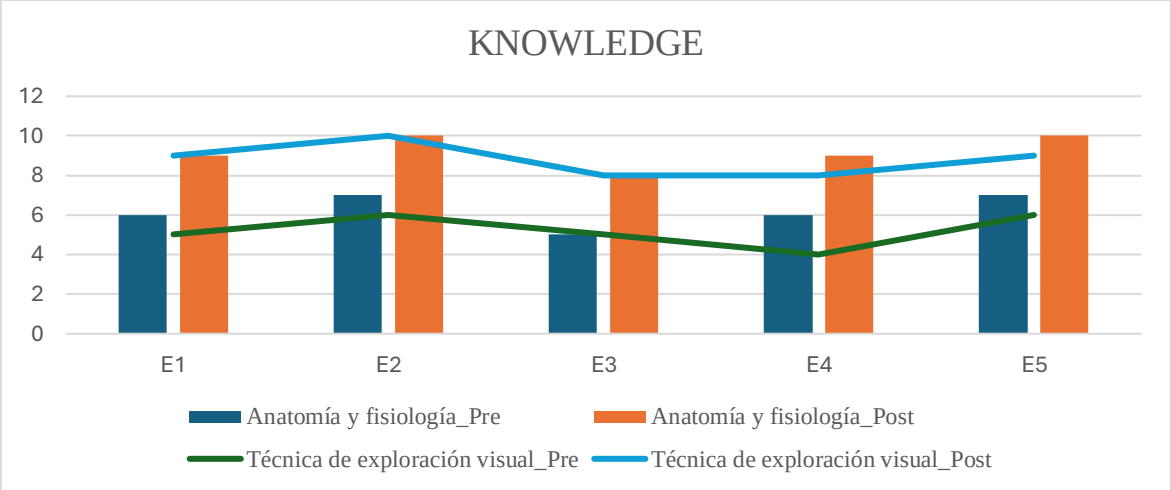
The process began with a diagnostic assessment using two closed-ended questionnaires administered via Microsoft Forms. The first (20 items) assessed knowledge of the anatomy and physiology of the visual system. The second (30 items) explored the technical aspects of visual assessment and its applicability in non-hospital settings.

In the pretest, three students (60%) answered 12 out of 20 questions correctly in anatomy and physiology, while two (40%) answered 8 out of 20. The main errors were concentrated in anatomical-functional content requiring clinical integration, such as retinal nutrition, aqueous and vitreous humor dynamics, presbyopia, and stereoscopic vision. The

technical component was the area of greatest difficulty. The group showed its lowest performance in this component, with an average of 15 out of 30 correct answers (50%). Three students (60%) had difficulties applying standardized procedures, especially regarding standardized distances, visual acuity recording, and confrontation techniques. In the basic direct ophthalmoscopy assessment, performed for educational purposes and under academic supervision, two students (40%) correctly identified the main structures of the fundus, while three (60%) made errors in identifying the optic disc, arteriovenous relationships, and foveal location. In the clinical-contextual component, three students (60%) correctly identified the relevance of systemic history such as diabetes mellitus and the use of associated medications. However, two (40%) showed weaknesses in interpreting clinical criteria for visual acuity (VA), particularly at the 20/200 threshold, as well as in the systematic evaluation of external eyelid signs.

Overall, the initial assessment revealed a heterogeneous level of knowledge, with strengths in general concepts of ocular anatomy and significant limitations in visual examination techniques, instrument use, and clinical interpretation criteria. This analysis allowed for the identification of priority areas for reinforcement before field practice (Figure 1). After the implementation of the theoretical-practical training program (Figure 2), a consistent improvement was observed in all evaluated domains.

Figure 1. Assessment of knowledge and technical aspects.



Note: The graph shows a consistent increase in performance from pretest to posttest for all five students (E1–E5, coded to preserve anonymity), in both Anatomy and Physiology and the Technical component. In the posttest, scores are concentrated in areas with accuracy percentages above 80%, demonstrating greater homogeneity in the group's performance.

The most marked improvement is observed in the Technical component, which initially showed the lowest percentages.

In anatomy and physiology, four students (80%) achieved at least 18/20 correct answers, reflecting greater anatomical and functional integration. In the technical component, four students (80%) achieved 24/30 or more correct answers, demonstrating appropriate application of standardized procedures, correct use of instruments, and standardized recording of results. Likewise, in ophthalmoscopy and clinical interpretation, four students (80%) correctly identified the optic disc, the arteriovenous relationship, the location of the fovea, and basic vitreous findings, showing improved semiological skills. In the clinical-contextual component, all five students (100%) correctly recognized relevant systemic history and clinical criteria associated with visual acuity.

The post-test showed a consistent improvement in academic performance across the different domains assessed, with the most noticeable increases in the technical component, initially the most difficult. These results demonstrate that the theoretical-practical training strategy allowed for the consolidation of both conceptual knowledge and the technical application necessary for visual field exploration (Figure 1).

Figure 2. Basic ophthalmic examination training course

(a) (b) (c)

(d) (e) (f)

Notes: (a) Introductory session on the theoretical foundations of eye examination; (b) identification of the parts of the ophthalmoscope and explanation of their function during the examination of the fundus of the eye; (c) collection of visual history and symptoms as part of the initial assessment; (d) initial execution of the confrontation technique with mismatch in the evaluator-patient alignment; (e) assessment of eye coordination and mobility by visual tracking; (f) verification and recording of findings in the assessment form used in the company.

Results of the second stage

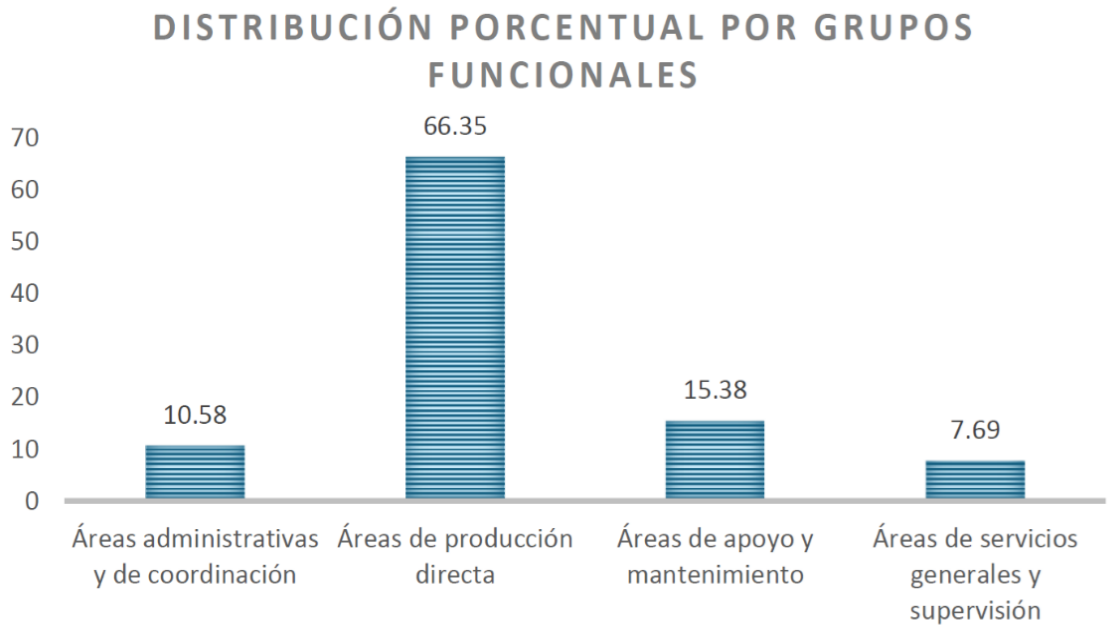
One hundred and four workers were evaluated. As shown in Figure 3, 66.35% work in direct production areas, highlighting the predominantly operational nature of the company and the need for visual prevention strategies in environments with high physical and ergonomic demands. 15.38% work in support and maintenance areas, with constant exposure to machinery and tools; 10.58% work in administrative and coordination areas, where

prolonged screen use can contribute to eye strain; and 7.69% are part of general services and supervision, involved in monitoring and supporting the production process.

Regarding the general data, we found the following:

The population evaluated was predominantly male: of the 104 workers included, 100 were men and 4 were women. Age ranged from 18 to 62 years, with a mean of 31.5 years, reflecting a predominantly young adult workforce. Regarding health conditions, 22 workers presented with chronic degenerative diseases, mainly diabetes mellitus and hypertension, highlighting the importance of monitoring and prevention strategies in the workplace. Regarding sleep habits, 29 workers reported sleeping 8 hours, 35 approximately 7 hours, 29 slept 6 hours, and 11 reported sleeping 5 hours or less, completing the total sample (n=104). Regarding the use of screens and electronic devices, 29 workers reported one hour of daily use, 21 two hours, 11 three hours, 17 between 4 and 8 hours daily, and 26 less than one hour. These categories complete the total sample (n=104) and show variability in exposure to electronic devices, with a subgroup that presents prolonged usage times potentially associated with visual fatigue.

Figure 3. Area of surveyed workers



Note: Percentage distribution of staff by area: direct production (66.35%), support and maintenance (15.38%), administrative and coordination areas (10.58%) and general services/supervision (7.69%)

Visual assessment

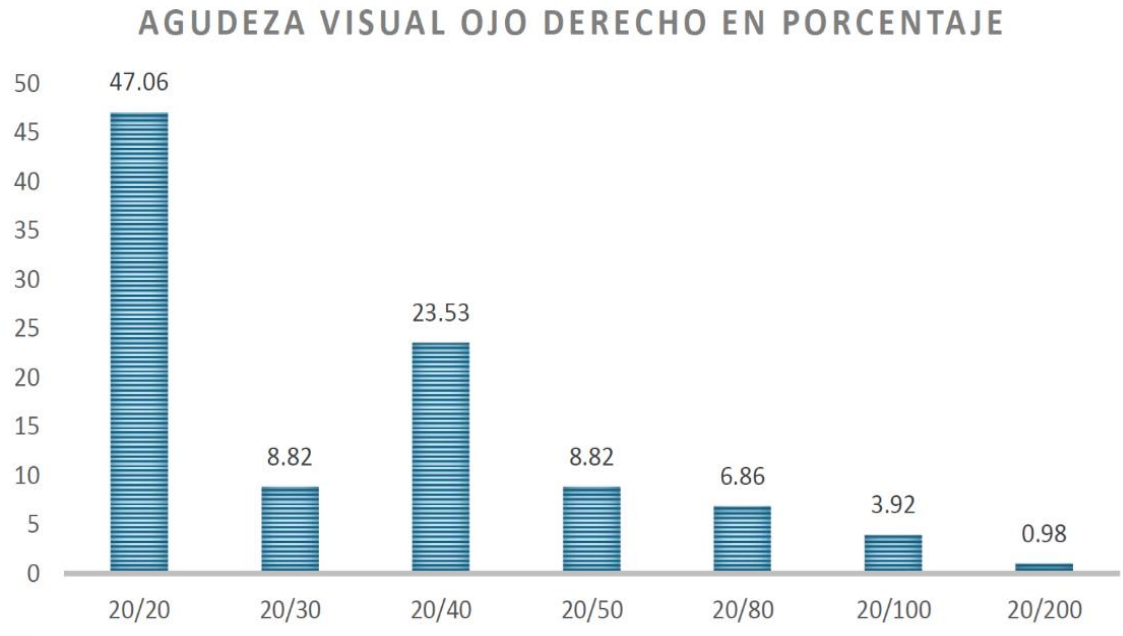
Regarding visual perception, 44 workers (42.3%) reported having some visual problem. Of these, 22 had a confirmed medical diagnosis, while the remaining 22 only expressed suspicion of an impairment without prior professional evaluation. These data highlight the need to strengthen early detection and timely follow-up in the workplace.

In the visual acuity analysis, 102 workers were included, as two participants did not complete the test due to incomplete data in the record, therefore, they were eliminated.

Visual acuity right eye

Of the 102 workers evaluated in their right eye, 47.06% presented visual acuity of 20/20, while the remainder were distributed among different levels of visual impairment. For the purposes of the analysis, any value equal to or less than 20/40 was considered visual impairment, a criterion under which approximately 44% of the workers showed reduced visual acuity (Figure 4).

Figure 4. Visual acuity of the right eye

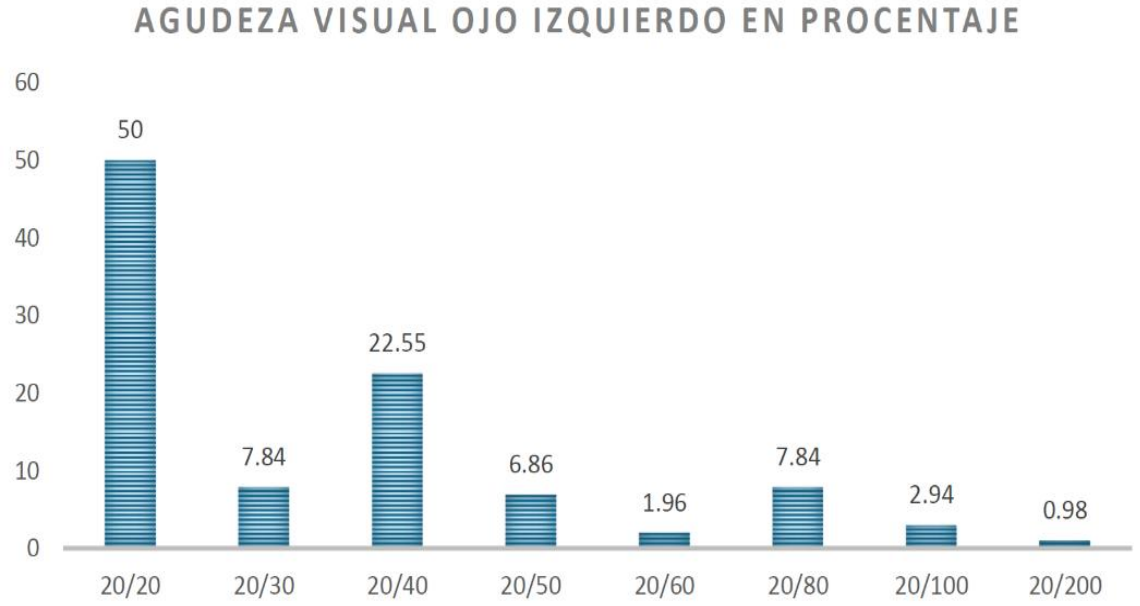


Note: The graph indicates that the majority of those evaluated have normal visual acuity (20/20) in the right eye, followed by a significant group with slight decrease (20/40). The percentages decrease progressively in lower acuities, suggesting a lower frequency of severe visual disturbances.

Visual acuity left eye

In the left eye, the distribution was balanced: 51 workers (50%) had visual acuity within normal parameters and 51 (50%) showed decreased visual acuity according to the established cutoff point (Figure 5). These results demonstrate a similar frequency of visual impairment between both eyes in the evaluated population.

Figure 5. Visual acuity left eye



Note. In the left eye, visual acuity is predominantly 20/20, followed by 20/40; lower acuity categories are infrequent, with isolated cases requiring ophthalmological follow-up.

Visual acuity assessment with correction

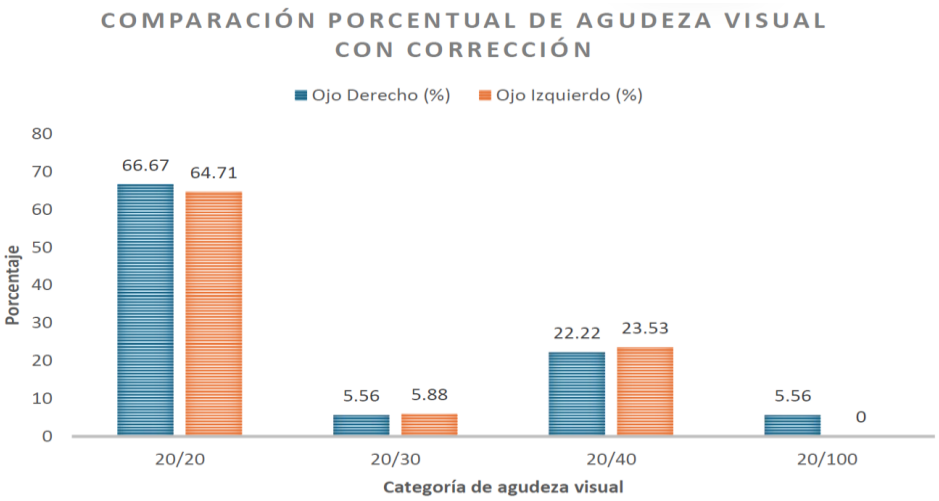
Figure 6 shows the percentage distribution of visual acuity with optical correction in the 18 workers who wear glasses. In the right eye, 12 (66.67%) achieved 20/20 with correction, while 4 (22.22%) recorded 20/40 and 1 (5.56%) 20/100. In the left eye, 11 (64.71%) achieved 20/20, 4 (23.53%) 20/40, and 1 (5.88%) 20/30. No cases of 20/100 were observed in the left eye.

Eye symptoms

Of the 104 workers evaluated, 99 (94.2%) reported at least one predominant eye symptom, while 5 (5.06%) indicated no symptoms at the time of the assessment (Figure 7).

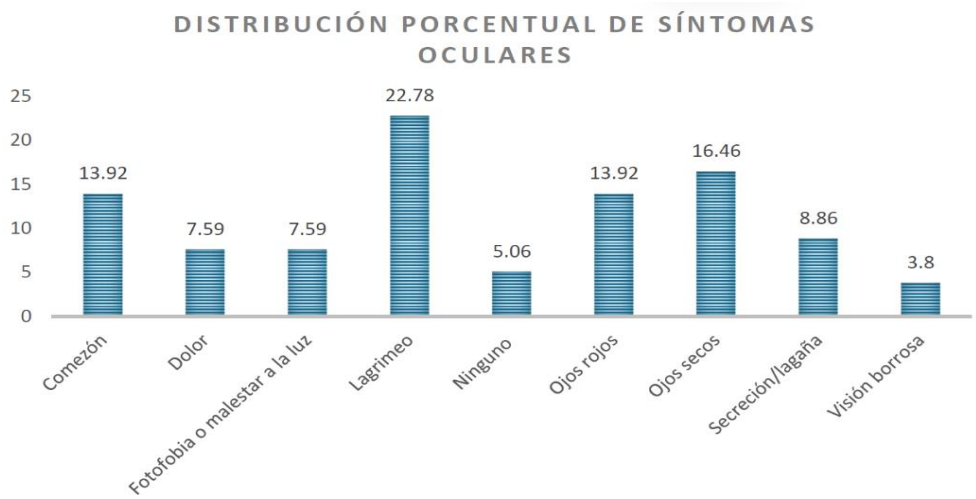
The most frequent symptom was tearing (22.78%), followed by dry eye (16.46%), itching, and red eyes (13.92% each). Less frequently reported symptoms included eye discharge (8.86%), eye pain (7.59%), light sensitivity (7.59%), and blurred vision (3.8%).

Figure 6. Visual acuity assessment with correction



Note: Percentage distribution of visual acuity with optical correction in the 18 workers who reported using glasses. The majority achieved 20/20 in both eyes, with lower proportions observed at 20/30 and 20/40. Cases of visual acuity ≤ 20/100 were rare.

Figure 7. Eye symptoms



Note: The graph shows that the most frequent eye symptom is tearing, followed by dry eyes. Itching and red eyes are found at an intermediate level of frequency, with similar proportions. Other symptoms such as eye discharge, pain, and light sensitivity are less frequent, while blurred vision and the absence of symptoms are the least frequent categories.

Results of the third stage

Positive findings from the experience

The feedback gathered indicates that the experience was highly significant for the students (Table 1), as it allowed them to connect theoretical content with its practical application in a real work environment. Participants noted that this approach fostered deeper learning compared to previous curriculum experiences, strengthened their academic motivation, and contributed to greater professional confidence through direct interaction with workers and specific eye health situations. Furthermore, the experience reinforced their professional identity and their understanding of the role of nursing in productive contexts.

Supervision and support

During the preparation and execution of the intervention, the students received academic and clinical supervision. The process was supported by two nurses and an internist, who provided technical guidance and ongoing support in the application of the visual assessment tests and the analysis of the findings. This support ensured the safety of the procedures and guaranteed compliance with the established clinical criteria.

Tensions, insecurities and self-criticism

However, feelings of insecurity and self-criticism also emerged. Some students acknowledged that, despite being in their sixth semester, they had gaps in basic knowledge related to ocular anatomy and certain visual assessment techniques. The introduction of procedures such as visual field testing was novel and challenging for them, highlighting the need to integrate this content more systematically from the early stages of their training.

Taken together, the testimonies reveal a dual dimension: on the one hand, the value of practical experience as a significant pedagogical strategy; on the other, the need to revise the curriculum sequence to foster more robust preparation before encountering real-world contexts. This balance between strengths and areas for improvement provides valuable input for reflecting on and adjusting nursing training strategies, particularly regarding visual assessment in non-hospital settings.

Table 1. Students' perception of the experience.

Category	Students' perceptions
Teaching methodology	E1: " *If classes were taught this way, we would learn more, because the content is not usually linked to real experiences."*
Linking theory and practice	E1: " *We never give importance to certain issues until we get to the clinical field; in this experience we understood it better* ."
Impact on learning	E5: " *In this activity we learned more than in three years of our degree; we were truly fascinated by the experience* ."
Perceived academic workload	E2: " *Although it was a burden because it was an additional activity to the workload of studies, we went gladly to gain experience."*
Professional empowerment	E4: " *When we are in front of the workers, we feel as if we really know how to perform as professionals* ."
Limitations in prior knowledge	E2: " *We felt bad because, even though we are in our sixth semester, we didn't remember the anatomy clearly, much less the visual assessment* ."
New content	E3: " *We had never heard of visual field testing or its application; it was the first time we had encountered it* ."
Feeling of inadequacy	E1: " *Sometimes we felt that we did not have the necessary foundation to confront the workers, which generated insecurity."*
Assessment of reflective practice	E3: " *In the end, this experience showed us how important it is to reinforce basic knowledge and apply it in real life.* "
Improvement proposal	E2: " *It would be better if these practices were given from previous semesters, so we wouldn't arrive so insecure to the real practice* ."

Note: The table summarizes students' qualitative perceptions by category, demonstrating high acceptance of the methodology and the integration of theory and practice, with a reported impact on learning and professional empowerment. E1–E5 correspond to the five focus group participants, coded to preserve anonymity.

Although the sample size was small, the findings did lead the teachers involved to a deep reflection on the teaching and learning techniques used and on the relevance of strengthening these contents from early formative stages.

Discussion

The discussion is structured around major thematic axes that facilitate the systematic interpretation of the results.

Skills gap and relevance of the industrial scenario

The gaps detected in knowledge of ocular anatomy and basic ocular assessment techniques among advanced semester students are consistent with that described by Bisso et al. (2020), who point out deficiencies in health training for the care of people with visual disabilities, absence of standardized content and limitations in communication skills and adapted assessment.

In our study, transferring the training experience to an industrial setting allowed students to connect theoretical content with a concrete problem, recognize the usefulness of visual screening, and develop basic clinical and communication skills in a non-hospital context. These findings suggest that situated practice can contribute to reducing the previously described theory-practice gap (Bisso et al., 2020).

Effect of structured training

Following the training intervention, improvements were observed in the identification of possible visual risk factors such as inadequate lighting, prolonged exposure to screens and sustained visual effort, as well as in the formulation of preventive measures (ergonomic adjustments, visual breaks and referral criteria).

These results are consistent with evidence showing that guideline-based training can improve knowledge and practice in eye care (Ghattas, 2025). Although Ghattas's study was conducted in a hospital clinical setting, the training rationale is comparable: structured training, accompanied by clear performance criteria, is associated with better decisions and greater safety in practice.

Curricular implications and expansion of skills

The review by Sharbini et al. (2025) documents the limited incorporation of ophthalmic content into undergraduate studies and the concentration of training in later stages or continuing education. It also indicates that nursing participation in vision screening is feasible and safe when standardized training and supervision are provided.

Consistent with these findings, our results support the relevance of integrating curricular modules on basic eye history and assessment, visual acuity measurement, eyelid hygiene, patient education, and referral criteria, always with supervised practice and defined performance thresholds. This strategy could contribute to strengthening student preparation

and reducing the previously noted training gap (Bisso et al., 2020; Sharbini et al., 2025), in line with evidence on the positive effects of structured training (Ghattas, 2025).

Occupational profile and potential exposure to visual risks

The higher concentration of workers in direct production (66.35%) suggests potential exposure to particles, dust, and agents typical of the industrial environment. The literature indicates that eye injuries occur more frequently in operational roles and recommends targeted workplace interventions, such as eye protection and specific training (Martín-Prieto et al., 2021).

Similarly, international frameworks propose integrating eye health into the overall management of organizational risks and productivity (International Agency for the Prevention of Blindness & International Labour Organization, 2023). However, our study did not measure objective environmental variables (dust levels, humidity, or lighting), so these associations should be interpreted as consistent with existing evidence and not as direct causal relationships.

Eye symptoms and working conditions

The high frequency of ocular symptoms observed in the sample is consistent with studies that associate environments with dust, dry air, or prolonged exposure to irritants with ocular surface alterations and dry eye symptoms (Hernández-Llamas et al., 2020; Alves et al., 2023). However, given that no quantitative environmental assessment was performed, the findings should be interpreted as plausible associations.

From a preventative perspective, interventions such as improved ventilation, education on visual breaks, and promotion of eye surface care could be considered within institutional occupational health programs.

Working with screens in administrative areas

Although administrative areas represent 10.58% of the staff, some workers reported prolonged screen exposure. A recent meta-analysis documents high prevalences of computer vision syndrome and its association with exposure time (Ccami-Bernal et al., 2023).

In this sense, the technical recommendations on lighting, monitor ergonomics and scheduled breaks described in official regulations can be considered cost-effective preventive strategies to reduce visual asthenopia. (Ministry of Labor and Social Welfare, 2008).

Sleep and eye health

The variability in sleep patterns observed in the sample is clinically relevant. A systematic review and meta-analysis confirms the association between poor sleep quality and dry eye disease (Gu et al., 2024). These data suggest that sleep hygiene could be incorporated as a complementary component in eye health education programs.

Optical correction and productivity

Limited or not always effective use of optical correction was identified. This phenomenon is consistent with the global deficit in effective refractive error coverage noted by the World Health Organization (WHO, 2024). Furthermore, experimental evidence shows that timely correction can be associated with improvements in work productivity (Reddy et al., 2018).

Consequently, institutional strategies for refractive screening and timely referral could be considered as potential organizational implications, always in coordination with specialized services.

Safety culture and personal protective equipment

The consistent use of eye protection equipment is a key component in industrial settings. In small and medium-sized enterprises (SMEs), compliance with personal protective equipment (PPE) requirements is associated with a safety culture, training, and supervision (Khoshakhlagh et al., 2024). Therefore, the provision of PPE should be accompanied by training programs and behavioral reinforcement strategies.

Situated learning and student perception

Student testimonies reveal a perceived gap between theoretical training and the real demands of professional practice, a phenomenon previously described (Gassas & Ahmed, 2024). The literature shows that active methodologies such as simulation, experiential learning, and guided reflection are associated with greater motivation, self-efficacy, and

transfer of learning when clear performance criteria exist (Alharbi et al., 2024; Zhao et al., 2024).

In our experience, situated practice generated an increase in the perception of professional competence, in line with studies that report improvements in critical thinking and perceived security after structured simulation interventions (Alharbi et al., 2024; Acevedo Gamboa, 2025; Zhao et al., 2024; Diaz-Jurado et al., 2023).

In the field of basic eye assessment, the identified gaps (field testing, eye anatomy and assessment logic) support the need to incorporate explicit and standardized curricular spaces with supervised training and defined competency criteria, as recommended by recent reviews (Sharbini et al., 2025; Ghattas, 2025).

Even with a small group, the findings are consistent with the literature and allow us to outline a reasonable training route: combine simulation with situated practice, evaluate the progression of skills through pre- and post-intervention measurements, and analyze the impact on the work environment (Saifan et al., 2021; Sharbini et al., 2025).

Conclusions

The teaching and learning experience using basic eye screening in an industrial setting allowed nursing students to apply theoretical knowledge to a real-world scenario, strengthening their skills in basic eye assessment, initial clinical analysis, and decision-making in non-hospital environments. Furthermore, the results showed a significant improvement in academic performance after the training intervention, particularly in the technical component, reinforcing the value of situated practice as a pedagogical strategy.

The project provided valuable information for the evaluated workforce by identifying visual acuity declines detected during screening and potential risk factors associated with the work environment. While longitudinal indicators of productivity or well-being were not assessed using specific instruments, the intervention generated input for strengthening preventive actions and promoting visual health in the industrial sector.

The implementation of active methodologies, including situated practice, problem-based learning, and guided reflection, energized student participation and fostered the integration of theory and practice. At the same time, it allowed the teaching-research team to more closely monitor the development of competencies in basic eye examination and preventive education, maintaining consistency with the formative approach described in the study.

Although the size of the participating group was small, the experience demonstrates that this type of intervention can constitute a replicable training strategy in other academic and professional contexts. More than an isolated practice, it represents an opportunity to consolidate the training of professionals with the capacity for contextualized intervention, prepared to respond to emerging needs in diverse settings.

The findings underscore the importance of incorporating visual health as a cross-cutting component in nursing education and occupational risk management. In this regard, the implementation of systematic training, prevention, and monitoring programs for visual acuity and ergonomic factors is suggested, both in academic and business settings, in coordination with specialized services when required.

Future lines of research

Systematic curriculum evaluation, focused on the elements of the graduate profile, incorporating practical scenarios in work environments. This approach would allow for the analysis of the coherence between academic training and the real demands of the professional context, in order to reduce the identified gap between theory and practice.

This research on occupational health and the role of nursing in production environments aims to evaluate the performance, competencies, and impact of nursing interventions in the workplace. Based on these findings, standardized care and visual screening protocols could be developed, tailored to the specific needs of industrial settings.

References

Acevedo Gamboa, F. E. (2025). Experiencia basada en simulación en enfermería: Una mirada desde la didáctica. Revista Repertorio de Medicina y Cirugía, 34(2), 216–223. https://revistas.fucsalud.edu.co/index.php/repertorio/article/view/1623

Ahmed, S. K., Mohammed, R. A., Nashwan, A. J., Ibrahim, R. H., Abdalla, A. Q., Ameen, B. M. M., & Khdhir, R. M. (2025). Using thematic analysis in qualitative research. Journal of Medicine, Surgery, and Public Health, 6, 100198. https://doi.org/10.1016/j.glmedi.2025.100198

Alharbi, A., Nurfianti, A., Mullen, R. F., McClure, J. D., & Miller, W. H. (2024). The effectiveness of simulation-based learning (SBL) on students' knowledge and skills in nursing programs: A systematic review. BMC Medical Education, 24(1). https://doi.org/10.1186/s12909-024-06080-z

Almeyda Hernández, W. G. (2024). Salud ocular: Conocimiento y su cuidado en estudiantes de enfermería de una universidad pública de Ica [Tesis de licenciatura, Universidad Nacional San Luis Gonzaga]. Repositorio Institucional. https://repositorio.unica.edu.pe/items/b6dab56f-dc6b-4835-909b-ec67a33152e8

Álvarez, L. M. (2022). Influencia del entorno de práctica de enfermería en el desempeño laboral. Salud, Ciencia y Tecnología, 2, 63. https://doi.org/10.56294/saludcyt202263

Alves, M., Asbell, P., Dogru, M., Giannaccare, G., Grau, A., Gregory, D., Kim, D. H., Marini, M. C., Ngo, W., Nowinska, A., Saldanha, I. J., Villani, E., Wakamatsu, T. H., Yu, M., & Stapleton, F. (2023). TFOS lifestyle report: Impact of environmental conditions on the ocular surface. The Ocular Surface, 29, 1–52. https://doi.org/10.1016/j.jtos.2023.04.007

Baum, F., MacDougall, C., & Smith, D. (2006). Participatory action research. Journal of Epidemiology and Community Health, 60(10), 854–857. https://doi.org/10.1136/jech.2004.028662

Bisso, C., Narváez, J., Sepúlveda, T., & Torrealba, A. (2020). Conocimiento de los profesionales de la salud frente a la atención de personas en situación de discapacidad auditiva o visual. Revista Confluencia, 3(2), 156–160. https://doi.org/10.52611/confluencia.num2.2020.482

Ccami-Bernal, F., Soriano-Moreno, D. R., Romero-Robles, M. A., Barriga-Chambi, F., Tuco, K. G., Castro-Diaz, S. D., Nuñez-Lupaca, J. N., Pacheco-Mendoza, J., Galvez-Olortegui, T., & Benites-Zapata, V. A. (2023). Prevalence of computer vision

syndrome: A systematic review and meta-analysis. Journal of Optometry, 17(1), 100482. https://doi.org/10.1016/j.optom.2023.100482

Díaz Jurado, L. C., Cedeño Tapia, S. J., Escalona Márquez, L. N., Reimundo Acosta, E. G., Fernández Nieto, M. I., & Rodríguez-Carrillo, R. O. (2023). Guías y videos de simulación clínica para el aprendizaje autónomo de enfermería. Revista Habanera de Ciencias Médicas, 22(2), e0013. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1729-519X2023000200013

Flatela, L., & Xulu-Kasaba, Z. (2024). Assessing eye health knowledge and practices amongst primary health care nurses in a rural district, South Africa (Version 1; peer review: 3 approved with reservations). F1000Research, 13, 1530. https://doi.org/10.12688/f1000research.159132.1

Gassas, R. S., & Ahmed, M. E. (2024). How nurses perceive the gap between knowledge and practice. Enfermería Clínica, 34(2), 120–129. https://doi.org/10.1016/j.enfcle.2024.02.002

Ghattas, A. H. S. (2025). Effect of eye care clinical guidelines training on nurses' knowledge, attitude, and practice and eye complications among critically ill patients: Pre and post-study design. BMC Nursing, 24(1). https://doi.org/10.1186/s12912-025-03390-5

Gu, Y., Cao, K., Li, A., Wang, J., Guo, Y., Hao, Y., Tian, L., & Jie, Y. (2024). Association between sleep quality and dry eye disease: A literature review and meta-analysis. BMC Ophthalmology, 24(1). https://doi.org/10.1186/s12886-024-03416-7

Gungor, S., Andı, S., Akçoban, S., & Tosun, B. (2025). Knowledge, attitudes and practices of intensive care nurses regarding eye care. Journal of Clinical Nursing, 34(11), 4747–4756. https://doi.org/10.1111/jocn.17733

Hernández-Llamas, S., Paz-Ramos, A. K., Marcos-Gonzalez, P., Amparo, F., & Garza-Leon, M. (2020). Symptoms of ocular surface disease in construction workers: Comparative study with office workers. BMC Ophthalmology, 20(1). https://doi.org/10.1186/s12886-020-01548-0

International Agency for the Prevention of Blindness, & International Labour Organization. (2023). Eye health and the world of work. https://www.iapb.org/es/learn/knowledge-hub/elevate/work-and-economic-growth/eye-health-and-economic-development/

Khoshakhlagh, A. H., Malakoutikhah, M., Park, J., Kodnoueieh, M. D., Boroujeni, Z. R., Bahrami, M., & Ramezani, F. (2024). Assessing personal protective equipment usage and its correlation with knowledge, attitudes, performance, and safety culture among

workers in small and medium-sized enterprises. BMC Public Health, 24(1). https://doi.org/10.1186/s12889-024-19517-3

Lami, S., & Ayed, A. (2023). Predictors of nurses' practice of eye care for patients in intensive care units. SAGE Open Nursing, 9, 1–6. https://doi.org/10.1177/23779608231158491

López Briceño, S. Y., Corona Vargas, A., & Morales Camacho, Á. I. (2021). Conocimiento del personal de enfermería en los cuidados oftálmicos de los pacientes de terapia intensiva adultos. International Journal of Advanced Multidisciplinary Research, 8(12), 29–37. https://ijarm.com/pdfcopy/2021/dec2021/ijarm4.pdf

Martín-Prieto, S., Alvarez-Peregrina, C., Thuissard-Vasallo, I., Catalina-Romero, C., Calvo-Bonacho, E., Villa-Collar, C., & Sánchez-Tena, M. Á. (2021). Evolución de lesiones oculares en el trabajo en las comunidades autónomas españolas en el periodo 2008–2018. Archivos de Prevención de Riesgos Laborales, 24(2), 17–29. https://doi.org/10.12961/aprl.2021.24.02.03

Morales León, J. E., Romero-Díaz de León, L., Sánchez Muñoz, C. E., & Guerrero Melo Samper, A. (2022). Agudeza visual: Revisión y actualización. Lux Médica, 17(50). https://doi.org/10.33064/50lm20223433

Najaffard, N., Mohammadi, A., Mojtahedzadeh, R., & Zarei, A. (2024). E-portfolio as an effective tool for improvement of practitioner nurses' clinical competence. BMC Medical Education, 24, 114. https://doi.org/10.1186/s12909-024-05092-z

Organización Mundial de la Salud. (2023). Manual para la implementación del tamizaje visual y ocular. https://www.who.int/es/publications/m/item/vision-and-eye-screening-implementation-handbook--information-sheet

Ramada-Rodilla, J. M., Domenech, B., Ronda-Pérez, E., Sánchez-Brau, M., Tauste, A., & Seguí-Crespo, M. (2025). Pantallas digitales y salud visual en el trabajo: Un riesgo emergente que exige acción inmediata. Archivos de Prevención de Riesgos Laborales, 28(3), 10–14. https://doi.org/10.12961/aprl.2025.28.03.01

Reddy, P. A., Congdon, N., MacKenzie, G., Gogate, P., Wen, Q., Jan, C., Clarke, M., Kassalow, J., Gudwin, E., O'Neill, C., Jin, L., Tang, J., Bassett, K., Cherwek, D. H., & Ali, R. (2018). Effect of providing near glasses on productivity among rural Indian tea workers with presbyopia (PROSPER): A randomised trial. The Lancet Global Health, 6(9), e1019–e1027. https://doi.org/10.1016/S2214-109X(18)30329-2

Saifan, A., Devadas, B., Daradkeh, F., Abdel-Fattah, H., Aljabery, M., & Michael, L. M. (2021). Solutions to bridge the theory-practice gap in nursing education in the UAE: A qualitative study. BMC Medical Education, 21(1). https://doi.org/10.1186/s12909-021-02919-x

Secretaría del Trabajo y Previsión Social. (2008). *Norma Oficial Mexicana NOM-025-STPS-2008, condiciones de iluminación en los centros de trabajo*. Diario Oficial de la Federación. https://www.dof.gob.mx/normasOficiales/3581/stps/stps.htm

Sharbini, S., Hashim, S. B. H., Abdul-Mumin, K. H., & McKenna, L. (2025). Ophthalmic care education and training in nursing: A scoping review. Nurse Education Today, 144, 106484. https://doi.org/10.1016/j.nedt.2024.106484

Universidad Autónoma de San Luis Potosí, Unidad Académica Multidisciplinaria Región Altiplano. (2020). Espacio de formación: Anatomía I (Licenciatura en Enfermería) [Programa de asignatura]. https://www.uamra.uaslp.mx/ProgramasAcademicos/Detalle/96#gsc.tab=0

Wei, F., Kao, L., Chang, C., & Chung, J. (2025). Enhancing nursing education through e-portfolios: Evaluating the impact on learning effectiveness, self-efficacy, and job satisfaction of NPGY trainees. BMC Medical Education, 25(1). https://doi.org/10.1186/s12909-025-07497-w

World Health Organization. (2024). SPECS 2030 initiative. https://www.who.int/initiatives/specs-2030

Zhang, Y., Li, C., Zhou, Y., & Yu, X. (2025). Knowledge, attitudes and practices of critical care nurses regarding eye care across 17 hospitals: A multicentre cross-sectional survey. Nursing in Critical Care, 30, e70120. https://doi.org/10.1111/nicc.70120

Zhao, W., Xu, M., Tian, Q., Han, Y., Wang, Z., & Zhang, W. (2024). The impact of simulation-based learning on nursing decision-making ability: A meta-analysis. Clinical Simulation in Nursing, 93, 101576. https://doi.org/10.1016/j.ecns.2024.101576

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