



ARTICLE IN HUMANITIES, SOCIAL SCIENCES, AND PEDAGOGY IN HEALTH

Web application for teaching Community Hygiene in the Hygiene and Epidemiology program

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ABSTRACT

Introduction: the use of Information and Communication Technologies in the health system contributes to improving the effectiveness and efficiency of the sector.

Objective: to develop a web application for teaching the discipline *Education at Work* in the subject *Community Hygiene* within the Hygiene and Epidemiology program.

Methods: applied, descriptive, and technological innovation research with a general dialectical-materialist methodological approach. Theoretical methods (historical-logical, analysis-synthesis, induction-deduction, modeling) and empirical methods (document analysis, interview, scientific observation) were used for requirements gathering, analysis, and design of the web application.

Results: a web application was designed that includes undergraduate and postgraduate studies in Hygiene and Epidemiology, a help system, relevant information, and access to the subject *Community Hygiene* through the virtual classroom, virtual clinic, and repositories. The interface features horizontal menus with access to undergraduate, postgraduate, library, virtual classroom, virtual clinic, and departments, integrating the description of the professional model, curriculum, and teaching resources.

Conclusions: the web application represents one of the best means to foster the development of skills that facilitate learning by competent professors, contributing to the improvement of their performance for correct decision-making in each area, as well as to the development of students' skills. It promotes individualized teaching, interactive learning, and a participatory and creative attitude, contributing to the transformation of the teaching-learning process.

Keywords: HEALTH EDUCATION; MEDICAL INFORMATICS APPLICATIONS; HYGIENE; TEACHING; EDUCATIONAL TECHNOLOGY.

INTRODUCTION

The technological revolution has profoundly transformed many aspects of daily life. In health systems, Information and Communication Technologies (ICT) are advancing preventive medicine and patient education, yielding significant economic savings and health benefits. Today, ICT constitutes a socializing force potentially more influential than home or school, permeating nearly all facets of daily life and becoming a top priority in both formal and informal education.⁽¹⁾

Health informatics—or medical informatics—applies computer science and communications to health through medical software, forming part of health technologies. Its primary goal is to support health professionals and improve the quality of care. This field combines computer science and health care to optimize the acquisition, storage, retrieval, and use of health and biomedical information.⁽²⁾

Recent advances in ICT—particularly their interconnectivity via the internet—have significantly impacted educational organization and learning processes.⁽³⁾ Rapid scientific and technological progress challenges education to raise its standards. ICT enhances, strengthens, and transforms educational practice, improving teaching performance and service quality.⁽⁴⁾

Creating educational environments that harness this potential and applying ICT didactically represent unprecedented challenges. It is essential to understand the limits and risks that new technologies pose to education and to reflect critically on the emerging societal model and its consequences.⁽⁵⁾

In educational contexts, ICT plays a fundamental role and is increasingly essential for universal access to knowledge. It has been pivotal in democratizing education, and its appropriate use ensures high-quality learning. Moreover, ICT supports teacher training, professional development, and more efficient educational management.⁽⁶⁾

At the 1998 World Conference on Higher Education in Paris, UNESCO issued the “World Declaration on Higher Education for the Twenty-First Century,” stating in Article 11: “The full potential of new information and communication technologies must be used to renew higher education by expanding and diversifying the transmission of knowledge.”⁽⁷⁾

Martínez,⁽⁸⁾ emphasized that Cuban Medical Education urgently requires innovations responsive to 21st-century technological changes. He advocated strengthening networked learning, educational resource production, and institutional repositories, and stressed the need to teach students sufficient knowledge, competencies, and skills in technology use.

ICT has become an integral part of students’ lives, offering unprecedented access to digital information and resources. International cooperation agencies have historically influenced public policy design in member countries to bring the interconnectivity demanded by the knowledge society into classrooms, foster innovative learning, and enable new forms of educational massification.^(9,10,11,12)

“Education in the Workplace” is a key organizational form of professional training in the Health Technology program. This work–research training process defines specific skills students must acquire each academic year, making the role of the supervising professor essential for tailoring instruction to the professional profile.^(13,14)

The Hygiene and Epidemiology program includes multiple training pathways:

- Skilled worker (9th grade) in Vector Surveillance and Control (VLAV)
- Intermediate technician (9th and 12th grade) in VLAV
- Intermediate technician (12th grade) in Hygiene and Epidemiology
- Bachelor's degree in Hygiene and Epidemiology

This program has unique characteristics compared to other health technology careers. The "Education in the Workplace" discipline, which supports core courses each year, is crucial due to its influence on the formation of superior technicians and professionals across multiple fields.

Given these considerations, this study aimed to develop a web application to support the teaching of the "Education in the Workplace" discipline within the "Community Hygiene" course in the Hygiene and Epidemiology program at the "Dr. Ernesto Che Guevara de la Serna" Faculty of Medical Sciences in Pinar del Río.

METHODS

This study employed applied, descriptive, and technological innovation research methods, underpinned by a dialectical-materialist philosophical framework. This approach guided the selection of theoretical, empirical, and mathematical-statistical methods to achieve the study's objective.

Theoretical Methods:

- Historical-logical: Examined the evolution of teaching approaches in "Education in the Workplace" within the Community Hygiene course.
- Analysis-synthesis: Enabled comprehensive understanding of the teaching-learning process, identifying essential elements, relationships, and general characteristics.
- Induction-deduction: Supported requirement gathering, analysis, and web application design.
- Modeling: Used to structure information and guide application design.

Empirical Methods:

- Documentary analysis: Reviewed relevant institutional and academic documentation.
- Interviews: Conducted with professors, tutors, and students to validate requirements.
- Scientific observation: Applied to identify and confirm the core educational problem.

RESULTS

The developed web application is accessible at: uvspr.pri.sld.cu.

The main interface features an intuitive design with two horizontal navigation menus:

- Top menu: About, Methodological Aspects, Contacts, Help
- Main menu: Home, Undergraduate, Postgraduate, Library, Virtual Classroom, Virtual Clinic, Departments

Under Undergraduate → Hygiene and Epidemiology, users access hypertext links detailing the professional model, including:

- Career characterization
- Object of work
- Modes and fields of action
- Work positions and core functions
- General objectives
- Curriculum
- Value systems
- Methodological and organizational guidelines
- Workplace education instructions
- Proposed core and elective courses
- Implementation of curricular strategies

Each element is presented with explanatory text and supporting visuals (Fig. 1).

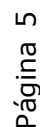


Fig. 1 Career page interface.

Selecting Curriculum displays courses organized by academic year, semester, and discipline (Fig. 2).



By accessing the subject Community Hygiene, you access a page that describes it (Fig. 3).



The Library section offers access to various digital resources (Fig. 4).



Fig. 4 Library page interface.

Clicking **Virtual Classroom** redirects to the institution's Moodle platform, with the path: *Teaching Area* → *Undergraduate* → *Health Technologies* → *Hygiene and Epidemiology* → *CRD* → *2nd Year* → *Community Hygiene* (Fig. 5).

The Moodle course includes:

- An interactive forum for Q&A between students and instructors
- The official course syllabus (objectives, content, evaluation system, bibliography, educational strategies, values)
- A Bibliography folder with supplementary readings
- Self-study materials in Word format
- Assessment tools: quizzes, assignments, surveys, and workshop classes

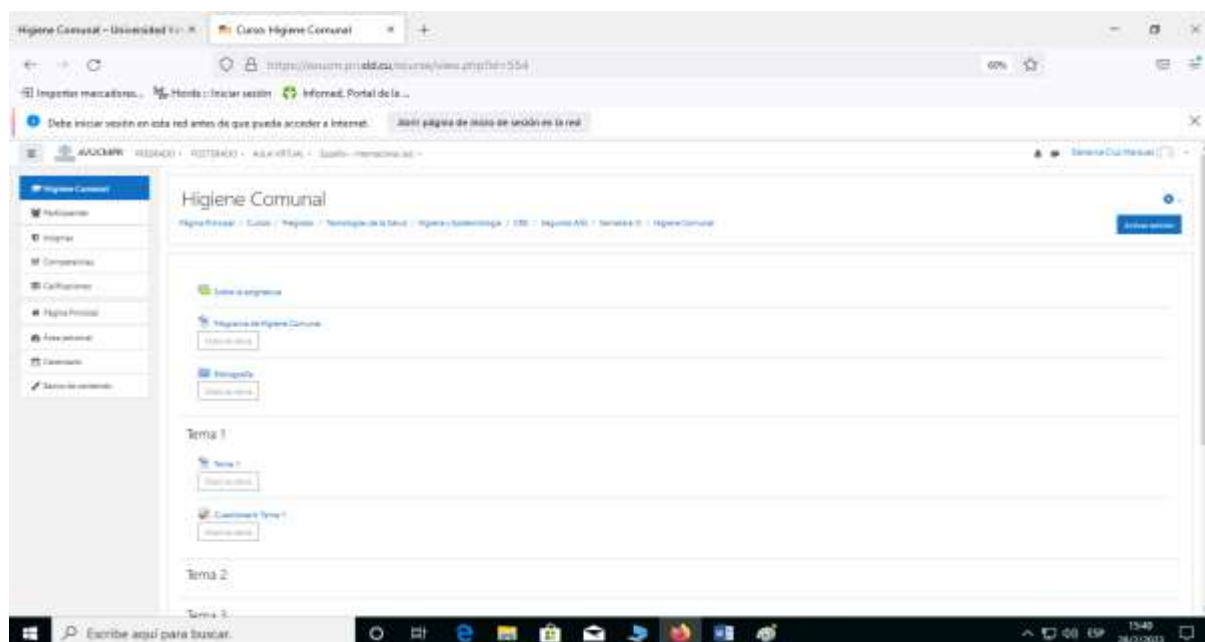


Fig. 5 Subject: Community Hygiene in the Hygiene and Epidemiology degree.

DISCUSSION

This web application is an innovative tool that addresses key gaps in the training of Hygiene and Epidemiology students and tutors. Its design adheres to Nielsen's (1995) usability principles, which remain highly relevant after 29 years as a benchmark for web usability and error identification.⁽¹⁵⁾

The application fulfills core usability criteria:

- Visibility of system status: Clear hierarchical menus and navigation paths
- Match between system and real world: Uses familiar educational and medical terminology
- User control and freedom: Intuitive navigation with no data loss
- Consistency and standards: Uniform menus, icons, and terminology
- Error prevention: Informative validation messages
- Recognition over recall: Visible menus reduce memory load
- Flexibility and efficiency: Supports both novice and expert users
- Aesthetic and minimalist design: Avoids information overload
- Help and documentation: Easily accessible and concise

This initiative aligns with similar ICT integrations in medical education:

- Quesada-Suárez et al.⁽³⁾ developed a web app for "Bibliographic Description" teaching
- Hernández-Lezcano et al.⁽⁴⁾ created a platform for "Defense Preparation"
- González-Cruz et al.⁽¹²⁾ designed an information architecture for communal and water hygiene
- Fundora Sosa et al.⁽¹³⁾ built a system for mandatory disease reporting
- Azcuy-García et al.⁽¹⁴⁾ developed multimedia for Medical Entomology and Vector Control

Unlike subject-specific tools, this application offers a comprehensive solution integrating curriculum management, virtual classroom access, and digital repositories. Its Moodle integration leverages existing institutional infrastructure, enhancing sustainability.

The tool directly addresses the lack of a structured “Education in the Workplace” program, providing tutors with organized access to the professional model, curriculum, yearly competencies, and teaching resources—thereby standardizing practical training.

For students, it enables ubiquitous, autonomous learning, supports individual needs, and fosters active participation through forums, assignments, and online assessments—shifting them from passive recipients to engaged learners.

This development responds to Martínez’s,⁽⁸⁾ call for technological innovation in Cuban Medical Education and aligns with UNESCO’s,⁽⁷⁾ mandate to harness ICT for knowledge dissemination and educational renewal.

Limitations include:

- No formal usability testing with real users
- Lack of standardized instruments (e.g., SUS) to measure satisfaction or learning impact
- Absence of technical architecture details, security protocols, or contingency plans
- Focus limited to Community Hygiene without cross-curricular extension
- Results from a single institution, limiting generalizability

Future Perspectives

- Short-term: Conduct usability testing with representative users using standardized tools (e.g., SUS)
- Medium-term: Expand to other core courses (Epidemiology, Food Hygiene, Communicable Diseases) and health technology programs; develop a skills-tracking module with automated feedback
- Analytics: Implement learning analytics to identify usage patterns, study times, popular resources, and student challenges
- Long-term:
 - Evaluate academic and professional impact through longitudinal studies
 - Develop a mobile app for ubiquitous access
 - Integrate emerging technologies (augmented reality for hygiene simulations; AI for personalized tutoring and content recommendations)

CONCLUSIONS

A comprehensive web application was successfully developed to support the “Education in the Workplace” discipline in the Community Hygiene course. It facilitates individualized, interactive, and autonomous learning, promotes student engagement, and transforms the teaching–learning process by placing students at the center. The tool cohesively integrates the professional model, curriculum, didactic resources, and Moodle access, adhering to Nielsen’s usability principles. It enhances both instructor effectiveness—through structured guidance for practical training—and student development—through 24/7 resource access. By addressing the critical gap of an unstructured workplace education program and providing practical support for tutors, this application offers a replicable model of educational innovation in health sciences with strong potential for expansion across disciplines and institutions.

Conflict of Interest

The authors declare no conflicts of interest.

Authorship Contribution

All authors contributed to conceptualization, formal analysis, project administration, original draft writing, review, editing, and final manuscript approval.

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