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Original article

Interactive multimedia package on major grains: an innovative educational tool

Paquete de multimedias interactivas sobre granos principales: una herramienta educativa innovadora

Pacote interativo multimídia nos grãos principais: uma ferramenta educacional inovadora

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ABSTRACT

Information and Communication Technologies, when applied to pedagogy, provide avenues for users to acquire the necessary knowledge. Multimedia plays an important role in this approach to the pedagogical process. This term refers to the combined use of different communication tools: text, images, sound, animation, and video. This article aims to promote the multimedia package on major grains as an innovative pedagogical tool, an alternative to textbooks. The Neobook 5.8 programming platform is used for this project, designed for the development of multimedia and other software

Translated from the original in Spanish

tools. The methods employed were analysis and synthesis, historical-logical analysis, and surveys. The result is an innovative pedagogical tool that provides students, professionals, and producers with valuable knowledge about agriculture in general and major grains in particular. It can be concluded that the interactive multimedia package on major grains constitutes a tool that facilitates the acquisition of general basic knowledge in an economical and practical way, thus promoting proper training on said crops (corn and beans), from a more interactive position.

Keywords: agriculture; software; pedagogical; multimedia teaching.

RESUMEN

Las Tecnologías de la Información y las Comunicaciones, puestas en función de la pedagogía, dota de vías para adquirir los conocimientos necesarios para los usuarios. Dentro de su enfoque en el proceso pedagógico, la multimedia juega un papel importante. Este término se refiere al uso combinado de diferentes herramientas de comunicación: texto, imagen, sonido, animación y video. Este artículo tiene el objetivo de socializar el paquete de multimedias sobre granos principales como una herramienta pedagógica innovadora como alternativa a los libros. Para este se utiliza la plataforma de programación Neobook 5.8, la cual está diseñada para el desarrollo de multimedias y otras herramientas informáticas. Los métodos empleados fueron análisis y síntesis, histórico-lógico y encuesta. El resultado es una herramienta pedagógica novedosa que pone al alcance de los estudiantes, profesionales y productores valiosos conocimientos sobre la agricultura en general y los granos principales en particular. Se puede concluir que el paquete de multimedias interactivas sobre granos principales constituye una herramienta que facilita la adquisición de conocimientos básicos generales de una manera económica y práctica, favoreciendo así la correcta capacitación sobre dichos cultivos (maíz y frijol), desde una posición más interactiva.

Palabras clave: agricultura; programa informático; pedagógica; enseñanza multimedia.

RESUMO

As tecnologias de informação e comunicação utilizadas na pedagogia proporcionam meios de aquisição dos conhecimentos necessários aos usuários. Na sua abordagem ao processo pedagógico, a multimídia desempenha um papel importante. Este termo refere-se à utilização combinada de

diferentes ferramentas de comunicação: texto, imagem, som, animação e vídeo. Este artigo tem como objetivo socializar o Pacote Multimídia Grãos Principais como uma ferramenta pedagógica inovadora em alternativa aos livros. Para isso, é utilizada a plataforma de programação Neobook 5.8, que se destina ao desenvolvimento de multimídia e outras ferramentas computacionais. Os métodos utilizados foram análise e síntese, histórico-lógico e levantamento. O resultado é uma nova ferramenta pedagógica que disponibiliza conhecimentos valiosos sobre a agricultura em geral e os principais grãos em particular para estudantes, profissionais e produtores. Pode-se concluir que o Pacote Multimídia Interativo sobre os principais grãos constitui uma ferramenta que facilita a aquisição de conhecimentos básicos gerais de forma barata e prática, favorecendo assim o treinamento correto sobre estas culturas (milho e feijão) a partir de uma posição mais interativa.

Palavras-chave: agricultura; programa de computador; pedagógico; ensino multimídia.

INTRODUCTION

Books have played a fundamental role throughout history as vehicles of knowledge, culture, and wisdom. Since ancient times, books have been guardians of information, transmitting ideas, thoughts, and discoveries across generations (Brom, 2013). With the increase in book production through the printing press, the literacy process expanded rapidly, from millennia to centuries, and with this phenomenon emerged the possibility of democratizing culture and learning (Medrano Castrejón, 2023).

The technological revolution experienced in the 1970s constituted the starting point for the growing development of the digital age; research carried out in the early 1980s allowed for the convergence of electronics, computing, and telecommunications, enabling interconnection between networks. Thus, Information and Communications Technologies have become a strategic sector; their influence has since become increasingly present in the dynamics of society, and their successes depend largely on the ability to adapt to technological innovations for their own benefit (Granda Asencio *et al.*, 2019).

In today's knowledge-based society, it is essential for citizens to acquire new skills in order to respond to the demands of the changes brought about by the constant evolution of technology. These skills become essential elements of change in the new educational paradigm (Martínez Clares & González

Lorente, 2019). Consequently, education becomes a highly relevant social sphere, as it must train citizens who will be integrated into current and future society in the acquisition of these new skills, thus giving the educational system extraordinary significance (Díaz Garcia *et al.*, 2020).

Higher Education, in its teaching, research and extension functions, considers the promotion of a teacher capable of teaching their students to learn and think, supported by Information and Communication Technologies (ICT), as one of its main challenges in the present 21st century, towards a pedagogical culture that transcends traditional teaching-learning methods to one capable of training students as critical-reflective and active citizens, with the strengthening of their life and work skills, which will favor their insertion into the knowledge society (Caballero Díaz, 2022).

In the field of agricultural education, the existing limitations to effectively fulfilling its function find a valuable ally in new technologies, such as multimedia resources. These technologies become key tools for contextualizing knowledge to the different regions of influence of future professionals, providing them with flexible and comprehensive resources that allow them to make a significant contribution to society. Furthermore, these tools can be used to broaden future professionals' understanding of the current situation on the subject, both internationally and nationally, providing them with a broader and more up-to-date view of the reality in which they will practice their profession.

In this sense, multimedia technologies offer the opportunity to enrich students' education by providing them with access to up-to-date and relevant information on the agricultural sector, both locally and internationally. Thus, future professionals will be able to acquire a more complete understanding of their field of study and will be better prepared to provide innovative and effective solutions to the challenges facing society in this area.

This paper aims to promote the multimedia package on major grains as an innovative pedagogical tool and alternative to books.

MATERIALS AND METHODS

The main grains multimedia package was developed under the Neobook 5.8 system. Neobook Software is a powerful programming tool that allows users to create interactive applications without extensive programming knowledge.

With Neobook, users can take advantage of its extensive feature set, including drag-and-drop capabilities, database support, media integration, custom form creation, and much more. This programming tool also allows for the creation of applications that run in Windows environments, making it ideal for developers looking to reach a wide and diverse audience. Additionally, Neobook offers support for creating cross-platform applications, making it an attractive option for those looking to expand their reach beyond Windows.

Neobook is widely used by professionals and enthusiasts looking to create interactive presentations, electronic catalogs, information management systems, multimedia training programs, educational games, and much more. Its focus on ease of use and ability to generate high-quality results make it a popular choice for those looking to develop custom applications without the time and knowledge requirements associated with traditional programming.

Theoretical methods used

- Historical-logical: for the historical analysis of the problem being investigated.
- Analysis and synthesis: for the study of the bibliography and development of the theoretical framework of reference, in order to select the essential aspects on the topics to be addressed regarding crops in the multimedia package.

Empirical level methods

- Survey: In this case, a survey was conducted among 50 students and 10 professors in the Mountain Agronomy Department to determine the degree of preference and acceptance of the multimedia package.

RESULTS

The multimedia package on main grains as developed in the Department of Mountain Agronomy belonging to the Faculty of Forestry and Agricultural Sciences of the University of Pinar del Río "Hermanos Saíz Montes de Oca", by the research and development group of software applied to agriculture (Figure 1).

Figure 1. Multimedia package launcher on main grains

It can be used on Windows operating systems, from XP to Windows 10. The minimum requirements for installation are: listed Windows operating systems, 500 MB of RAM and 50 MB of hard disk space for installation.

Among the features of the multimedia package on main grains, a small, easily portable software, is that the first version only takes up 200 MB of hard drive space, so it does not require large storage media. It can be run integrated into the system, after installation, or portable. It is multiplatform software, as its great autonomy allows it to run on any Windows operating system currently in use, even on portable versions via USB. It does not require extensive requirements, so it can be used on computers with low technological resources. It saves all printing-related expenses and can be updated periodically. It protects the environment, as it eliminates all the major damage caused by the printing industry.

Process of programming and creating the multimedia package

Phase 1. Data collection

To gather the necessary information, an exhaustive bibliographic search was conducted using relevant keywords such as technology, agroecological management, corn, beans, multimedia, and

technological tools. The articles were collected from various renowned databases, such as Scopus, Google Scholar, and SciELO, which provided essential and supporting information for the development of the multimedia package.

Phase 2. Application design

The development of the application followed a sequence of steps, from planning to implementation. Initially, an outline of the application was created, followed by the user interface design, which defined both its appearance and user interaction. For this purpose, Neobook's design tools were used to build windows, buttons, menus, and other interface elements. Subsequently, the application content was generated, including text, images, videos, and audio, organizing it in a coherent and structured manner.

Once the design phase was complete, programming began, using the Neobook programming language to add interactivity and program the actions that would be triggered when interacting with the interface elements.

Finally, during the testing phase, all functionalities were verified to be operational, thus completing the application's development.

Phase 3. Launch of digital application

During this stage, the application's shortcomings were addressed through a continuous process of trial and error to ensure its functionality and, crucially, its alignment with the learning content about the importance of acquiring knowledge about the selected crops (corn and beans).

Regarding the app's launch, its implementation was planned in the San Andrés Mountain Agronomy Department, with the goal of evaluating both the effectiveness of the scheduled windows and the knowledge acquisition by users.

The decision was made to evaluate the application's functionality by measuring the level of satisfaction in the San Andrés Mountain Agronomy Department, the institution where it was implemented, which yielded the following results.

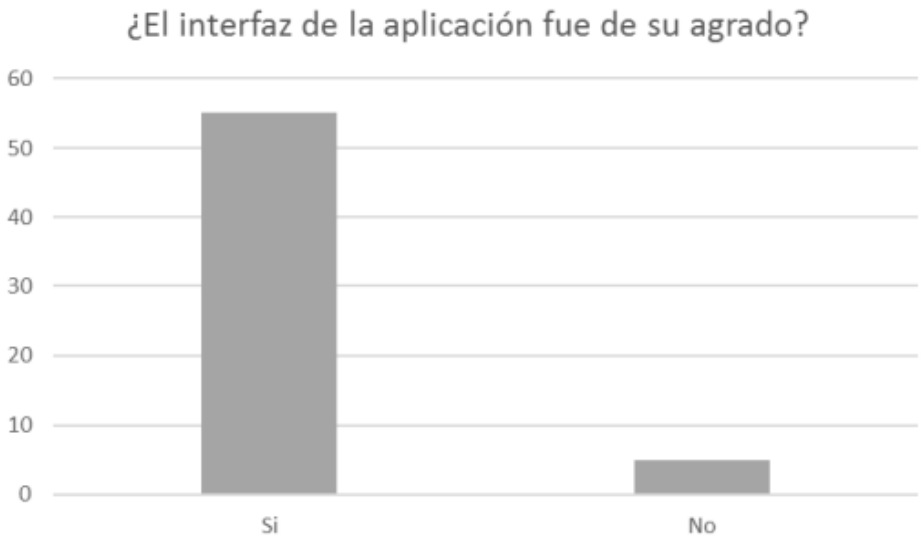

Figure 2. Measuring the impact of application design

Figure 2 shows that 91% of respondents indicate that the application has a user-friendly interface, easy to use, and as it is an application without an internet connection, it does not present connectivity problems, which facilitates its use at any academic level.

After a year of research, users at the Mountain Agronomy Department were surveyed to determine how they acquired crop information (beans and corn), using the multimedia package in the center's laboratory. The results of this survey are presented in (Figure 3).

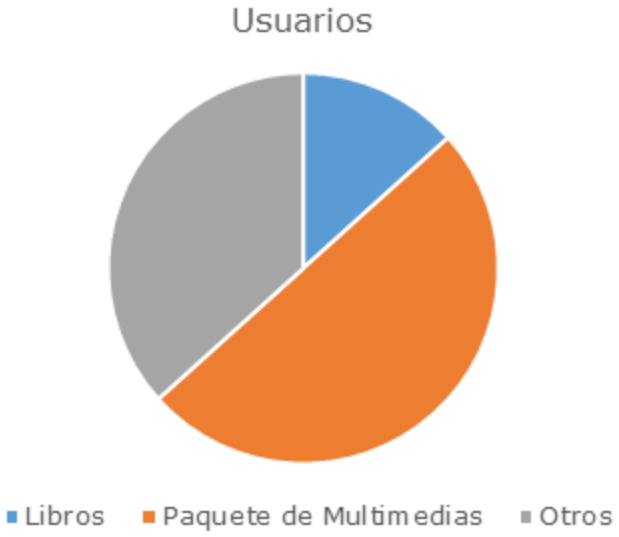

Figure 3. Measuring preferences for information sources

According to the survey, half of those surveyed preferred the multimedia package on major grains for conducting research and study on corn and bean crops. Thirty-six percent indicated they used other media, such as websites, Wikipedia, and Google, for this purpose. The remaining 14% expressed a preference for books as a source of information.

Considering the opinions of the surveyed users, several advantages have been established over hard copy bibliography (books) (Table 1).

Table 1. Comparison of the interactive multimedia package on main grains on books, according to current users

Comparison criteria	Multimedia package	Books
Cost	No costs because the information is chosen from websites and online books, which are free	It is worth its printing price and if you buy it already published it is worth what the publisher estimates.
Environment	It does not directly harm the environment	It damages the environment because the printing industry emits large amounts of carbon dioxide into the atmosphere, and printing requires many chemicals that are very harmful to nature.
Update	It is systematically updated with the bibliographies most recommended by experts.	To update it, you must purchase or print other types of books, which involves great expense and environmental damage.

Furthermore, the multimedia package fosters the culture of new trends in information communication. Today, the use of these technologies is even more necessary because teaching and learning methods are changing from face-to-face or blended learning to online meetings.

Advantages of using the multimedia package on major grains as a teaching tool

- A striking graphical interface (Figure 4), enhanced with colors similar to those of crops, makes it very attractive to the user and encourages interaction with the application, thus increasing the interest and motivation of users for the knowledge presented in the application.

Figure 4. Bean multimedia interface

- Extremely easy to update, as unlike the hard copy format, updates can be done online using up-to-date bibliographies. This keeps users as up-to-date as possible on such important crops, efficiently and quickly.
- User-developer relationship: Given the ease of updating, users can ask the developer to take into account their specific needs in future updates, thus covering the areas of knowledge that users specifically need.
- Self-assessment: Using the multiple-choice quiz (Figure 5) featuring multimedia, users can test the knowledge they have acquired during the learning process. They can also learn from mistakes made in this test, as they can return to the content mentioned and better prepare for their next attempt, thereby developing feedback.

Figure 5. Multimedia test. Example: corn multimedia

- It features images that make the learning process more interesting and engaging, especially in the phytosanitary aspect, which is so important for practical use by all agricultural students.
- The multimedia package on major grains provides comprehensive training for users, covering subjects such as Genetics, Botany, Soil Science, Plant Science, Plant Health, and History, among others. It also serves as a guide and provides guidance for users in their self-preparation, providing encouragement and motivation.

Opportunities for using a multimedia package in teaching major grains

- Interactive Visualization: Using the multimedia package allows students to interactively visualize the morphology, life cycle, and distinctive characteristics of major grains, such as corn and beans. This provides them with a deeper and more practical understanding, as they can observe each stage of crop development in detail through images.
- Access to multisensory information: The multimedia package offers the opportunity to present information in a multisensory way, involving both sight and hearing. This sensory variety can improve information retention and student engagement.
- Learning Personalization: The multimedia package allows content to be tailored to different learning styles. By incorporating visual and textual elements, individual student preferences can be catered to, providing a more personalized and effective learning experience. For

example, some students may learn better through images, while others may prefer information presented in written form.

- Geographic Contextualization: The multimedia package includes information on the geographic regions where the main grains are grown, displaying interactive maps, panoramic views of agricultural landscapes, and testimonials from local farmers. This geographic contextualization helps students understand the specific conditions under which each grain is produced, as well as the associated challenges and opportunities. For example, images of different corn-growing regions around the world could be shown, highlighting the differences in climate and soil.
- Stimulating creativity and innovation: Using a multimedia package can stimulate creativity and innovation by allowing students to explore grain-related concepts in a more dynamic and experimental way.

Currently, work is underway to develop and incorporate other content on major grains, such as rice, peanuts, soybeans, and sesame, into this multimedia package to enrich and expand the package's informational universe.

DISCUSSION

The interactive multimedia package on major grains offers a powerful tool to enhance student understanding and learning, similar to what Enríquez Silva (2020) describes in multimedia for interactive presentations. By combining images and interactive elements, it allows students to explore grain-related concepts, such as their morphology, life cycle, cultivation requirements, and economic importance, in a more dynamic and practical way.

This variety of multimedia resources not only facilitates the visualization and understanding of the topics, but also provides the opportunity to virtually experiment with agricultural scenarios, identify potential problems, and seek innovative solutions. For Vega (2015), the multimedia application supports students in the teaching-learning process, in their independence and self-management. Consequently, students not only acquire theoretical knowledge but also develop practical skills and a deeper understanding of agriculture, coinciding with what Romero *et al.* (2005) expressed in a multimedia application for teaching some soil characteristics. This prepares students to make significant contributions in this crucial field.

Learning through technological tools is motivating, because students do not feel pressure to acquire content chronologically predisposed according to their age (Chuqui Tandazo *et al.*, 2022).

This perspective is in line with the results obtained, as well as with the criterion that understands multimedia as a teaching-learning tool that improves the quality of education, as it breaks the boundaries of space and time. Furthermore, it ensures an immediate learning effect that enhances traditional teaching tools; this sets the stage for students to showcase their learning capabilities and innovations, as described in their studies by Mora Piña *et al.* (2019).

Considerations regarding potential inconsistencies in the methodology of the study on the interactive multimedia package on major grains are critical to ensuring the validity of the findings. Some potential limitations could include sample size, follow-up duration, and the diversity of students and educational contexts. However, despite these potential limitations, the use of the interactive multimedia package on major grains may be valid due to its ability to offer an immersive and dynamic learning experience. It not only provides information but also encourages active exploration and the possibility of self-assessment quizzes, which can significantly enrich the students' learning process.

An interesting perspective, with which the research agrees, is that of Valdés and Troche (2022) who express that the current stage, as a result of the Pandemic, has made possible the redesign of educational programs, with profound substantial changes in the training process of professionals, being the form of teaching organization that prevails today (non-face-to-face, distance), which breaks with traditional face-to-face education. Such a situation allows a greater use of ICT, due to the role of teaching materials in the teaching-learning process as basic carriers of the knowledge that the student must acquire.

The above suggests that future research should focus on thoroughly exploring the impact of using interactive multimedia as a teaching tool for students in the agricultural sector. It is crucial to understand how these tools can enhance the understanding of key agricultural concepts and promote more effective and meaningful learning in this field.

For this reason, the authors believe that using the interactive multimedia package on major grains as a teaching tool is an aspect that teachers and students of agricultural sciences should work on, particularly from a perspective that visualizes its opportunities and advantages.

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Conflict of interest

Authors declare no conflict of interests.

Authors' contribution

The authors participated in the design and writing of the article, in the search and analysis of the information contained in the consulted bibliography.