

Developing Interactive E-books as Medical Learning Devices



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Abstract

- The demand for multilingual learning devices for medical professionals, students, and hospital trainees has been on the rise in the past few years. The current pandemic has exacerbated this pressing global need. The effective and impactful realization of such devices requires designers to meet users' needs of autonomy, flexibility, and interactivity.
- Integrating appropriate pedagogical materials and design criteria is required as per literature review to deliver a robust framework for effective learning and fast adaptability in applications ranging from fundamental medical concepts to new and advanced diagnostics.
- The goal in the design of interactive e-books for medical applications is to create bilingual e-books to be used in mobile devices for health care students, professionals, and hospital trainees that are robust and sustained. Multilingual e-books can make widespread information effective.
- Specifically, this research aims to develop English-Spanish e-books capable of adapting medical teaching materials, different learning styles, and assessment tools, in collaboration with a medical educator and her team. Pre- and post-surveys are conducted to examine their effectiveness. This work aims to provide a framework for the design of more effective medical learning devices.

Introduction

Many educational methods and tools are widely available for medical learning and education, particularly given the fast advances in technology. Figure 1 illustrates several mobile devices and technology used for learning by medical educators and student trainees. Recent studies [1-4] have demonstrated the challenges and opportunities in further development of e-books for their wide use in cellulars, tablets, PCs, etc. as effective learning tools for medical education and hospital training.

In this study, new bilingual interactive e-books are designed to deliver an enhanced medical school learning experience with improved flexibility, autonomy, and outcomes that preserves the competence of our medical professionals. The e-books will offer rapid translation into practice and efficiency for remote learning.

This project is significant as multilingual resources are increasingly necessary in the current global health crisis and beyond, and e-books make widespread information easy and effective. The rapid development of transformative technology through improved e-books will provide support to healthcare professionals, students, and educators for the care of patients. Integrating digital technology, instructional design, and efficient pedagogical practices, we have created the first set of interactive e-books (English and Spanish) for implementation by medical educators and students.



Figure 1. Select mobile devices widely available for digital learning used in different fields.

Procedure

Below are the key steps for the e-book development in this study.

- 1) Research medical education and technology:** Perform literature review on current medical learning devices, education methods, learning styles for medical students, etc.
- 2) Identify e-book topic and strategize design:** Create a plan for e-book development with specific medical topics, goals and outcomes, as well as student audience, in mind.
- 3) Collect necessary materials:** Prepare images, videos, text, audio, pedagogical or training materials (games, quizzes, etc.) for instant feedback and improved retainment.
- 4) Develop e-book by integrating digital learning and instructional design:** Import and integrate materials and customize e-book template in Pages.
- 5) Test, evaluate and improve e-book:** Export Pages file to EPUB format, import EPUB file to a tablet (iPad), and upon verification of functionality then share with users.



Figure 2. E-book developmental framework process and main elements in this study.

Results

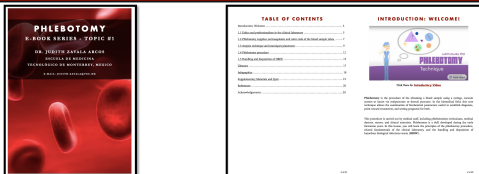


Figure 3. Snapshots of interactive e-book (topic: Phlebotomy), showing cover page and main elements including table of contents, introductory video, and visuals describing the content for readers.

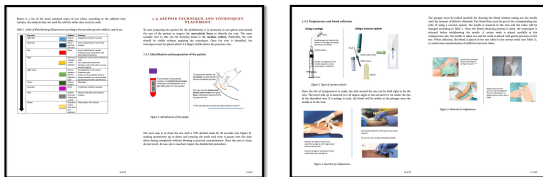


Figure 4. Illustration of other sections of the e-book describing the process of withdrawal of blood.

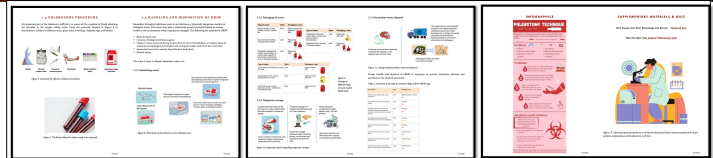


Figure 5. Images show (left) snapshot of e-book depicting necessary tools for the phlebotomy process, (middle) illustrations on the phlebotomy step-by-step procedure, and (right) infographic summarizing the e-book concepts as well as supplementary materials and assessment activity (quiz) and feedback.

LEARNING STYLE	Table 1 Relationship Between Learning Styles and Five Levels of Behavior				Table (left) illustrates the relationship between learning styles and five levels of behavior [5].
Behavior level	Diverging	Assimilating	Converging	Accommodating	
Personality type	Extroverted Feeling	Introverted Intuition	Extroverted Thinking	Extroverted Sensation	Individuals in the medicine profession show the predominant learning style is Converging .
Educational specialization	Arts, English, History, Psychology	Mathematics, Science, Physical	Engineering, Medicine	Education, Communication	
Professional career	Social service	Business, Information	Engineering, Medicine, Technology	Sales, Social service, Education	Successful e-books were created. Current work is underway to assess the impact on student learning via surveys.
Current jobs	Personal jobs	Information jobs	Technical jobs	Executive jobs	
Adaptive competence	Valuing skills	Thinking skills	Decision skills	Action skills	

Discussion / Conclusions

A prior model [6] is often used to outline the key curriculum design principles that underlie all direct instruction programs and are fundamental to most instructional materials. These principles state the need to: a) identify "big ideas" to organize content, b) teach explicit general strategies, c) scaffold instructions, d) integrate skills and concepts, and e) provide adequate means of review. Of these principles, we have applied four which are most relevant to the creation of e-books for medicine education. Because students benefit from flexible learning tools that adapt to different learning styles, it was our focus to apply the typical learning style characteristic of medicine professionals to these e-books. This led to the refinement of the first e-book on Phlebotomy to optimize usage for future efforts.

The tailored e-book was designed by balancing past technical document guidelines to increase retainment and engagement in medical learning as well as instructional design and pedagogical best practices (active learning). Medical students most often have converging learning styles which allow them to respond best to stimulus presented which later can be used in practical applications. Feedback from medical educator and students was obtained and adequately incorporated. Analysis of data and translation to Spanish are underway.

To our knowledge, this is the first attempt to combine digital technology, learning styles, medicine pedagogical materials, and instructional design to quickly create adaptive, interactive, self-sustained, multilingual and easy to use e-books, while reducing costs.

Future work includes the completion of other e-book topics and measuring how the combination of interactive materials strengthen the students learning outcomes.

References & Acknowledgements

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