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A Medical Informatics Distance-learning Course for Latin America
Translation, Implementation and Evaluation

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Summary

Background: There is a growing need and interest worldwide for healthcare and information technology professionals trained in medical informatics. Distance learning technologies are increasingly used to deliver such education, but have mainly been limited to the English language.

Objective: Describe the implementation and student satisfaction of a medical informatics course delivered in Spanish for a Latin American audience.

Methods: The course was based on the 10 x 10 program of the American Medical Informatics Association and Oregon Health & Science University that was translated and adapted to the Latin American setting. The initial course consisted of ten one-week units, currently the course has 15 modules that are delivered in 16 weeks with topics that address the needs of medical informatics in the region. We also administered an anonymous questionnaire of student satisfaction.

Results: A total of 499 individuals have enrolled in the course, and 70% have completed it. Most of the students have been healthcare professionals (86%), with the largest proportion from Argentina. Student satisfaction with all aspects of the course was high. After the initial experience and feedback from the students, the course has been adapted to better meet regional needs.

Conclusion: The initial experience obtained in training healthcare professionals in medical informatics in Latin America in their own language demonstrated that it could be used across the region, and this could represent a model for disseminating knowledge of medical informatics across other languages and cultures.

1. Introduction

There is a growing need to train individuals in medical informatics (MI), the field concerned with the capture, management and use of information in health and biomedicine [1]. MI is not only concerned with computers and technology, but also how information is obtained and used in context [2]. It is now generally recognized that MI is a discipline that requires trained professionals with the necessary expertise to use and apply its principles skillfully [3].

International programs using distance learning to deliver MI education have been developed in the United States [4, 5], New Zealand [6] and Europe [7, 8]. In Latin America, an international program has been developed in Brazil but is delivered by means of in-person training sessions and is not online [9]. A similar experience has been carried out in Peru [10]. Latin America is a wide and diverse region, making the delivery of in-person training programs a difficult task. Distance-learning programs, provided by Internet tools, may be a possible strategy to deliver MI education.

In 2005, the American Medical Informatics Association (AMIA) and the Department of Medical Informatics and Clinical Epidemiology of Oregon Health & Science University (OHSU) launched the 10×10 program. This program set as its goal the training of 10,000 healthcare professionals in the United States in MI by 2010. The program aimed to provide a global point of view, though was delivered in English and represented a United States-centric point of view. The program was designed to be a starting point for those hoping to acquire more expertise in MI, including through enrollment in formal educational programs such as the one offered by OHSU. Over 750 people have completed this version of the course by the end of 2009 [11, 12].

In order to develop a training program in MI that was more locally focused and delivered in the Spanish language, the MI task force of the Hospital Italiano at Buenos Aires (HIBA) entered into an agreement with OHSU and the School of Medicine of the Hospital Italiano at Buenos Aires to translate and adapt the OHSU 10×10 course to the Latin American region. This paper reports the experience of adapting, translating, implementing, and evaluating our effort.

2. Materials and Methods

Setting: HIBA is a non-profit health care academic center founded in 1853, since 2001 has also intended to contribute to this

enterprise through graduate and post-graduate education with great impact in the Latin American region. The educational offerings of HIBA include over 30 medical residency-training programs, 34 fellowship programs, a school of medicine and a school of nursing. The MI residency is one of the most recent medical residency programs, having been created in year 2000. Since 2006 it has also had an e-learning platform aiming to teach professionals all over the world who are interested in MI and other medical issues [13].

The adaptation of the course began in December 2005. The goal was to provide an introductory course on medical informatics similar to the English version by providing participants the initial tools for the development of solutions to specific healthcare problems using informatics principles. Moreover, at the end of the course, the participants would have acquired the initial skills necessary to implement healthcare information projects in their own workplace.

The initial course adhered to roughly the same outline as the English version from OHSU. When selecting the topics for the Spanish version of the course, we decided to exclude certain units, as "Evidence-based Medicine" and "MI Professional Development in the USA". We added some other topics that were relevant to our educational needs, such as "Use of Controlled Vocabulary and Terminology Services", "Digital Signature", and "Law on Privacy, Confidentiality". We also added additional material on "Picture Archive and Communication Systems" (PACS) in radiology and "Biological Signal Processing in MI". We also broadened coverage of the impact of MI on public health, focusing on epidemiological surveillance, immunization records, and geographic information systems. ▶Table 1 shows the main topic areas covered in the first course.

The initial course was designed to be delivered in ten one-week units, requiring about ten hours of work per week. The course was designed to be delivered through the virtual campus of the Hospital Italiano at Buenos Aires (http://campus.hospitalitaliano.org.ar) as shown in ▶Figure 1. It was based on a constructivist pedagogical model of collaborative learning guided by technology, in which students and teachers interacted by means of the Internet. The students had different backgrounds and each had different and unique needs so the tutor behaved as a facilitator promoting the discussion on the topics delivered throughout the course. The objectives were maximizing interaction, collaborative work and achieve collective knowledge [14] .

The learning management system used to deliver the course was Moodle (Modular-Object-Oriented-Dynamic-Learning-Module-Environment, http://moodle.org) a free, open-source package designed to help educators create effective online-learning communities. Moodle is presently used in more than 45,000 sites in 70 different languages in more than 200 countries.

The teaching modalities used for the initial course included lectures, threaded discussion boards, recommended readings, and self-assessment.

The lectures were available in two different formats from which students could choose. One format was a voice-over-Powerpoint presentation similar to those used in the OHSU course. The lectures were created using Articulate®. Individual lecture segments lasted 20–30 minutes, with each of the ten units divided into 5–8 segments. The other format was narrative material, readable on the screen or printed, with the same content as the Powerpoint slides but designed for reading. Each student could choose one (or both) of the formats.

Table 1 Description of modules and duration of the Spanish 10 ×10 course (initial course and current offering)

	Initial course offering	Current course offering
Duration and number of units	10 weeks – 10 units	16 weeks –15 units
Topics	• Overview of the discipline • Biomedical Informatics • Electronic Health Records • Decision Support and Health Care Quality • MI Standards: Privacy, Confidentiality and Security • Information Retrieval and Digital Libraries • Multimedia and Telemedicine • Organization and management issues in biomedical informatics • Biomedical Informatics Subspecialties • Information Systems in Public Health	• Characteristics of Healthcare Systems • Health informatics: the development of a new discipline • Anatomy of Health Information Systems. Components • Interoperability and Standards • Introduction to Biomedical Computing • Privacy, Confidentiality and Data Security; • Structure of Administrative Systems. Standards in Healthcare: a strategic need; • Knowledge Representation and Coding Systems • The Heart of a Health Information System: The Electronic Health Record • Without frontiers: Personal Health Records • The "Reason of Being": Clinical Decision Support Systems. Examples of Applications • Images, Signals and Reports in Simultaneous • Organizational Aspects and Project Management: Strategies to Accompany Change, Evaluation and Certification of Health Information Systems • A general view of other Disciplines in Health Informatics: Nursing Informatics, Telemedicine and Bioinformatics • A different point of view: Healthcare from Individuals to Populations. Chronic Disease Management

Fig. 1 | Screen capture of the Virtual Campus at HIBA

The threaded discussion boards allowed interaction among students. For each unit, the instructor would post several questions with aim of encouraging interaction and debate. Students would reply to the question and/or their classmates' replies.

Every week the teacher also assigned recommended readings from the textbook (Shortliffe et al., Biomedical Informatics: Computer Applications in Health Care and Biomedicine – 3rd Edition, Springer-Verlag, 2006) as well as additional articles related to the topic. The units were published weekly and preceded by a study guide, in which the learning objectives and the activities were described. The students self-assessed their learning process by means of ten multiple choice questions in each unit.

The students needed an Internet connection to enter the virtual campus to access the course. The content was designed so that even dial-up connection could be used. The material was published in HTML or PDF, with the audio-visual material was delivered via Flash format. Students could participate and communicate with the teachers in the discussion forum, where they could write a message that was de-

livered automatically to the teacher's e-mail box. The forum stored all messages and their replies. If the students had any technical problems or difficulties obtaining the course materials, the campus had a help desk that aimed to solve the problem within 24 hours.

Two surveys were administered to determine the students' opinions regarding aspects of the course: one related to the format – voice-over-Powerpoint vs. reading material – and the other assessed their perceptions of other aspects of the course. The surveys were anonymous, voluntary and web-based. Students were asked through the forum at the virtual campus to complete them after the last module was published.

The course was launched in March 2006 and, after four versions, currently offers 15 modules designed to be delivered in 16 one-week units, requiring about ten hours of work per week through the virtual campus of Hospital Italiano from Buenos Aires. The current modules are shown in ▶Table 1.

The teaching modalities used for the current version of the course include lec-

tures, threaded discussion boards, recommended readings, and self-assessment. The students also have to develop a group report that evaluates a healthcare organization and they have to describe the current status of the information system, with the premise that they will behave as consultants for the development of health information system that ensures a better quality in its process management. In order to perform the evaluation they need not only to describe the aspects and structure of the organization, resources available and the information technology (IT) component. In their final report they describe the organization and propose how a health IT (HIT) project should be encouraged based on the knowledge acquired throughout the course.

The final evaluation of the student consists of a written test where students have to answer four multi-part questions. All students who pass the evaluation obtain a certificate of completion issued by AMIA and the School of Medicine of Hospital Italiano from Buenos Aires.

3. Results

The course has been delivered to 499 registered students through December 2009, with 70% (n = 350) having completed the course. The overwhelming majority of students (86%) come from the healthcare professions, and 68% (339/499) are physicians.

Most of the students are from Argentina (47%), followed by Uruguay (25%), Chile (13%) and Cuba (8%). We have also had students from Colombia, Ecuador, Mexico, Guatemala, Paraguay, Venezuela, Bolivia, Spain, United States, Italy, Nicaragua, Peru and Switzerland.

We therefore not only had to translate the course, but also added information and examples describing HIT that was applicable to the region. We also had to create a 750-page handbook in Spanish to explain the course materials that was rated highly by students.

Students from the first version were surveyed about the preferred modality of the lectures and their overall perception of the course. A total of 96/143 students (67%) answered the survey on lecture modality; with 60% using both formats, 37% using the reading material exclusively, and 3% used the audio-visual format only. About 49% of those who preferred the combination of both formats stated they used the reading material first followed by the voice-over-Powerpoint format, whereas 31% used the voice-over-Powerpoint format first followed by the reading one. When asked about the quality of the content using a Likert scale (1 worst to 10 best) the reading material obtained an average score of 8.5, whereas the voice-over-Powerpoint format obtained an average of 7.6. The combination of both formats obtained an average of 8.6.

In the overall evaluation of the course survey, students were asked about the course characteristics, the interaction with the tutors, the modality of e-learning and the main features of the course using a Likert scale (1 worst to 5 best). The average scores obtained from 57/143 (39%) surveys are shown in ▶ Table 2.

Students were also asked how they planned to use the knowledge obtained from the course. About 42% answered that the course was preliminary training for an electronic health record implementation, 17,5% said the course taught them how to use the electronic health record, and 7% answered that the course trained them on how to assume a new role such as chief of medical informatics in their institution.

4. Discussion

This is the first experience of a distance-learning course on MI developed in Spanish for the Latin American region. The development of the course was encouraged by the fact that most of the current training available was in English language and courses were mainly taught in person that are barriers for potential Spanish speaking students. Furthermore, most of these courses do not take into account specific regional needs (e.g., American courses devote time to topics of less detailed interest in Latin America, such as the Health Insurance Portability and Accountability Act, HIPAA). The modification of the initial 10×10 course in English was mainly due to cultural differences in general, such as Latin American health system differs in comparison to the US and the standards for health data privacy are also different.

Providing a distance e-learning course created great challenges. It required a new attitude of students and teachers, such as a change from traditional face-to-face contact to virtual communication. From this experience, we think that a MI distance e-learning program was possible from the technical, pedagogical and the students' points of view. Other experiences have shown that the academic performance in graduates from distance learning courses in MI is similar to those that study on-campus [15].

It was an excellent initial startup using the possibility of adapting an already successful course and translate it to the needs of the region [16]. This preliminary approach allowed us to develop in less time a course in comparison to starting a course from "scratch" that had not been tested if it would really address the students' needs. This effort also has great potential as a model for translation and dissemination of MI education to audiences in other regions of the world that speak other languages like French speaking countries in Africa. The initial translation and adaptation of the course materials took approximately six months because it had to be translated first from English and then develop the materials in Spanish.

The contents of this introductory course on biomedical informatics are the first step in formal training that was lacking in our region and in Spanish language. The syllabus is mainly oriented to get the students to learn in theory all the involved aspects

Table 2   Student assessment of the initial 10×10 Spanish course features on 1–5 scale. (1 – worst, 5 – best)

Question	Score
1. Did the course content meet the program's description?	4.5
2. The course gave me practical and useful information for my daily work	4.1
3. Was the course correctly balanced? Was it interesting?	3.9
4. Did the teacher have adequate knowledge regarding the topics?	4.7
5. Was the teacher organized when presenting the contents?	4.6
6. Did the teacher answer the questions promptly?	4.6
7. Was the length of the course correct?	3.8
8. Were the course materials effectively presented? Was the surfing process easy?	4.4
9. Did the course fulfill my expectations?	4.2
10. Would I recommend this course to my colleges?	4.3
11. Which is my score regarding the e-learning part of the course?	4.3
12. Which score would I give to the whole course?	4.2

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related to the discipline with a special focus on the implementation and developing of health information systems (as shown in ►Table 1). The contents of the course are provided gradually so that students can first understand broader aspects of MI. The first modules describe the characteristics of healthcare systems in the region in comparison to the US and European countries, later to describe the discipline of health informatics, components of health information systems and the importance of interoperability and the use of standards. In the following units we describe different aspects that are components of health information systems such as: biomedical computing, legacy systems and redesign processes, EHR, CDSS, PHR, knowledge representation, PACS, and issues related to privacy, security and confidentiality of data. In these units we also provided information about the certification of EHRs, organizational issues and data analysis for healthcare management. In the latter units public health information systems and an overview on other specialties related to the field are provided, such as: nursing informatics, bioinformatics, telemedicine, web 2.0 and information retrieval.

Although the course has a strong focus on reading material students have an assignment that involves most of the topics involved in the course where they have to develop a group report based on an actual experience where they have to evaluate a healthcare organization (ideally where they are working and plan to implement an EHR). In the assignment they have to behave as consultants that evaluate all the aspects of the information system, and propose enhancements of the health information system with what they learned throughout the course.

Since this course might not fulfill all the learning needs of students planning to develop a career in health informatics, we have also developed other courses like an introductory course to HL7 in collaboration with HL7 Argentina and HL7 International that aims to introduce the key concepts of electronic messaging interoperability in health care. The course was initially developed in Spanish and later was translated into and adapted for the English language. Students are introduced to

the key concepts in electronic messaging standards and communication focusing on the implementation of the HL7 messaging system, to understand and apply the Reference Information Model (RIM) in instances of data exchange and to apply a reference model for the exchange of clinical documents. The students have weekly assignments with "hands-on" exercises on real interoperability problems.

The experience of nearly ten years of developing a four-year medical informatics residency program for training human resources in both theoretical and practical aspects of the discipline encourages us to develop a MSc degree program that will focus in depth the aspects of biomedical informatics for Spanish speaking students willing to have a career in the field. Currently our trainees actively participate in the analysis, design, development, implementation and evaluation of the Hospital Italiano's HIS project [13].

We carried out a survey in the first version of the course, so as to evaluate the experience from the students. The response rate was 67% (96/143), the results obtained could be biased by the fact that the survey was voluntary and anonymous, so most probably students that have completed the course and were satisfied with the contents chose to answer the survey. Another limitation of the survey is that because of the anonymity of the respondents we cannot evaluate if the voice-over-Powerpoint lecture format was better than reading format.

It has been proposed that MI is a discipline in constant evolution promoting interdisciplinary approaches, collaboration and methods of education [17, 18] which leads to the fact that the course contents are revised in order to add and modify existing data with the objective of providing more content that is Latin America-related in concordance with the current IMIA educational recommendations [19].

We have shown that MI education can be provided in Latin America via distance learning and students perceived this kind of training positively. We are constantly working on the improvement of the course, based on the comments and suggestions of our graduates, so as to provide a course that not only is an introduction to MI but can be used by professionals with different back-

grounds (e.g. IT, healthcare, management) that are part of a team that works on the implementation of HIT projects that are starting to being developed in the region.

This experience and the evaluation of the course graduates needs have encouraged us in the development of an MSc program in health informatics for the Latin American region.

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