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# Collaborative Production Model of Educational Resources for Human-Computer Interaction Community in Latino America

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## Abstract

Today, human-computer interaction (HCI) shows great activity, dynamism, and academic presence throughout the world, having special relevance in the Latin American region. The region is not only vast for its geographical space but also diverse and multicultural, where researchers and academics from this area or community have proposed and made known the benefits of the HCI that they can bring to today's society. However, some problems arise and need to be addressed in the HCI area in the Latin American region, such as the lack of training strategies and the availability of content and educational resources in Spanish. In order to mitigate this problem, the current work proposes a collaborative production model of educative resources for human-computer interaction developed in Latin America. The model preconizes a series of strategies and technological services to support the collaborative production and access of HCI educative resources such as videos, slides, handouts, textbooks, user experience analysis, and usability tests. The proposed model is tested throughout two real case studies conducted by teachers and researchers from different Latin American universities in order to produce and use the HCI educative resources for under- and postgraduate courses.

**Keywords:** HCI, webinars, textbooks, educational resources, collaborative production, SOA

## 1. Introduction

Nowadays, the area of research and education specializing in human-computer interaction (HCI) shows a high activity and a dynamic presence among academic groups from universities and research centers around the world. Human-computer interaction is an area of computer science that studies human interaction with computers. In other words, HCI studies how to design, develop, and evaluate new computational technology and information, in such a way they become easy to use and useful to human activities [1]. HCI plays a major role in the design of interactive systems since the nature of its knowledge body is multidisciplinary, for example, software engineering, sociology, computer science, neuroscience, design, artificial intelligence, and cognitive psychology [1–3].

In the last decade, the HCI has a special relevance in the Latin American region. A large number of researchers of HCI community have presented their contributions at several conferences [4]. However, some problems arise and need to be addressed in the HCI area in the Latin American region, such as the lack of training strategies and the availability of content and educational resources in Spanish. One solution is to develop HCI contents in terms of different formats such as demos, slides, handouts, textbooks, user experience analysis, and usability tests. The advantage of digital educational resources versus traditional formats is that they can be accessed and reused to be part of new online courses with different learning styles at a university level. The user can have access to educational resources with additional multimedia features (such as video, audio, animation and interactive applications, and 3D content), and finally they can update as often as necessary [5].

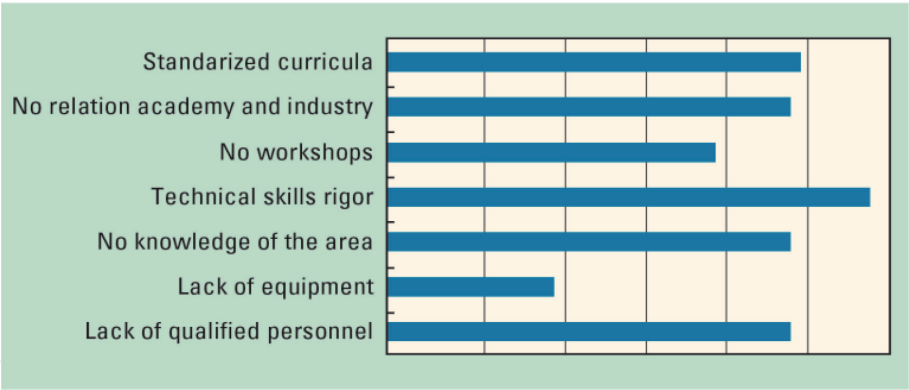
This work presents a model as an alternative solution for the collaborative production of educational resources, emphasizing various types of online resources available to the user. It is structured as follows: the next section shows the production issue of HCI education resources in the Latin American region; Section 3 presents a conceptual model for the collaborative production of education resources in HCI. The two subsequent sections implement the model in two real case studies where teachers and researchers from several universities cooperate in order to provide educational resources available in Spanish to the HCI community of Latin America.

## 2. Problem outline

The region of Latin America is not only vast for its geographical space but also diverse and multicultural, where researchers and academics from this area or community have proposed and made known the benefits of the HCI that they can bring to today's society.

Unfortunately, in Latin America, it has been more difficult to use the traditional educational resources, largely due to high costs and the lack of access to services. In addition, the publications that are in a foreign language with different cultural and educational contexts make this type of materials inaccessible for students at the Institution of Higher Education (IHE) in Latin America [6]. One reason for the high cost of textbooks is that most of them are produced outside the region [4]. The fundamental problem is not related to the lack of production capacity but to the difficulty of teachers or local authors to publish and distribute their own educational resources. The problem with the origin of the textbooks has several additional consequences, besides their cost [7]: most educational resources are not adapted to the context of higher education in Latin America, the latest versions being not available in a language mastered by most teachers and students, which creates a damaging perception of being in a lower position and that knowledge always comes from abroad [8].

In general, some educational resources produced in Spain are used by teachers since the beginning of this century, but the contents require explaining and adapting to Latin American educative context. One should not forget that one of the biggest problems is the lack of books, educational content, and related resources in this area [5, 6]. Other problems arise and need to be addressed in the HCI area in the Latin American region, such as the lack of training strategies and the availability of content and educational resources in Spanish as shown in **Figure 1**. According to that figure, note that it is also necessary to consolidate the technical skills in the area and establish communication mechanisms between professionals and academics in the future development of the HCI. The problem of access to HCI content for both teachers and students at a university level has several additional consequences, apart from its cost [9]; most of the contents are not adapted to the Latin American

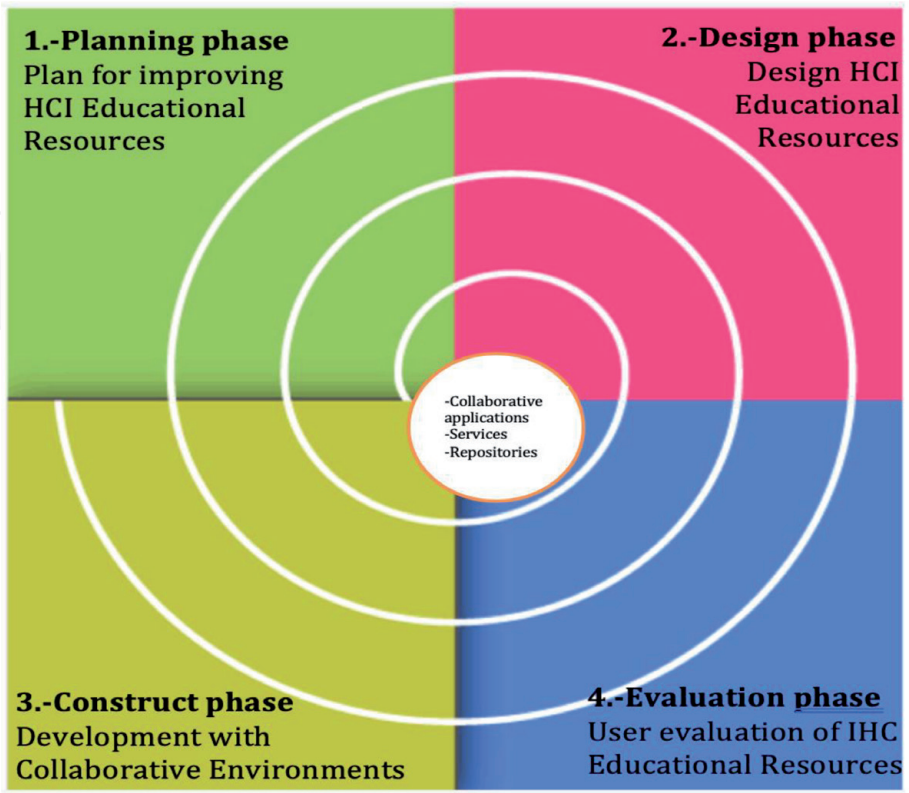


**Figure 1.**  
*Some issues related to teaching human-computer interaction [4].*

context, and the most recent versions are not available in a language most teachers and students dominate, creating a not very good learning experience and perceiving knowledge in general comes from the outside.

**3. Collaborative production model of educational resources for HCI**

This section proposes an extension of spiral model from Boehm software process model [10] to describe a collaborative production of HCI educational resources (see model of **Figure 2**). This model is characterized as an iterative, incremental, and interactive process. Then, in the early stage of planning phase, it is necessary to define a plan for the production of new HCI educational resources as well as the organization of human resources. It is involving here system analysts, media specialists and content producers are involved here. The next phase (design phase)



**Figure 2.**  
*Collaborative production model of HCI educational resources (inspired of Boehm’s model).*



focuses on the validation of new educational resources at the design level before launching a massive development of these resources. The construct phase is for the development of educational resources using collaborative environment; the process is directly influenced by learning and social networks, involving practice communities and collaborative tools. The fourth phase is for the evaluation of HCI educational resources using repositories to allow the content that is retrieved, recommended, appointed, grouped, and so on to be a contender to the future versions of the course.

Of note the collaborative applications, services, and online repositories are located in the center of the proposed model in **Figure 1**; at least one of these key elements is necessarily used by the participants in every phase of the development of educational resources. In fact, a multidisciplinary team is required to implement the previous model, including teachers, reviewers, researchers, content organizer, and content producer. They are involved in a huge effort of creating resources that are designed for use in formal and non-formal educational situations. The whole responsibility lies with the multidisciplinary team to provide creative content and give certain guarantee that it is the most suitable content that could be offered to each specific learning/teaching situation [5].

The next two subsequent sections implement the previous model in two real case studies where teachers and researchers from several universities cooperate in order to produce educational resources in Spanish language to the HCI community of Latin America.

4. Collaborative production of textbooks

The Latin project has developed an environment for the collaboration and production of a series of textbook in computer science such as the HCI book (**Figure 3**), and then the teachers can contribute whit sections or chapters to be put together into custom textbooks for the whole community.



The previous figure shows an excerpt from the HCI textbook titled *Temas de Diseño en Interacción Humano-Computadora*, in which the index and the whole content of this book is written in Spanish language with creative common license. All the chapters have a similar structure, namely, the objective of the document with theoretical and practical sections with solved exercises, self-evaluation, and bibliography [4]. The solved exercises illustrate how to apply the theoretical knowledge, and the evaluation sections allow the future readers a self-evaluation of HCI subjects.

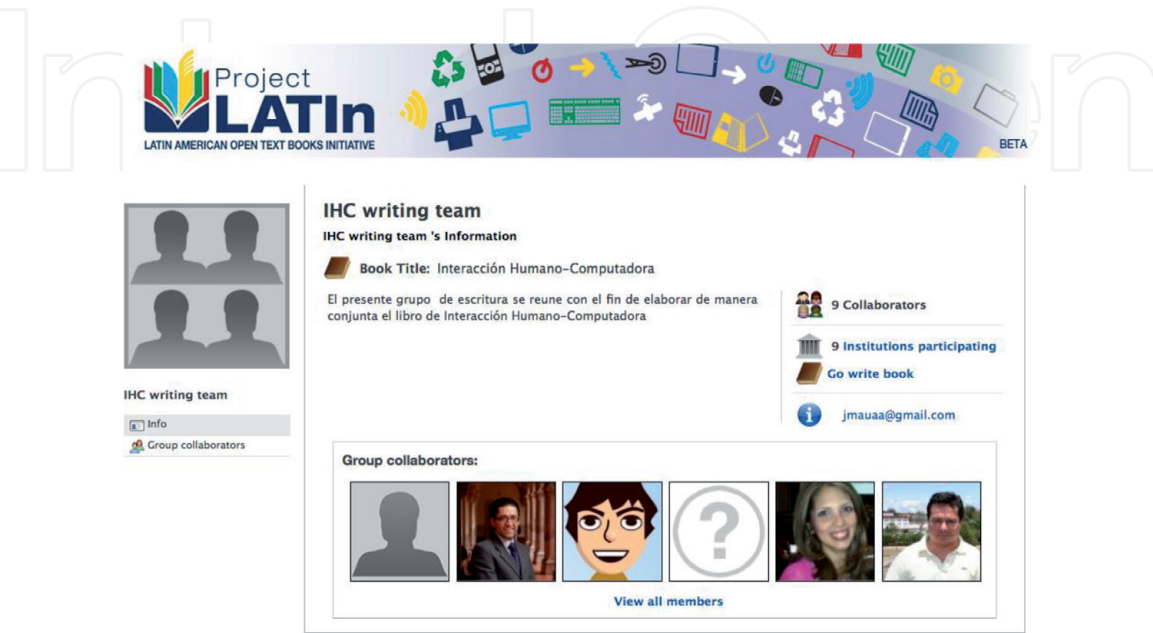
4.1 Collaborative applications

The writing textbook process starts with the formation of teams of collaborative work among the researcher teachers related with their knowledge area. The Latin project has built an application for collaboration and production of the HCI book, so that teachers and authors can contribute whit sections or chapters to be assembled into custom books for the whole community.

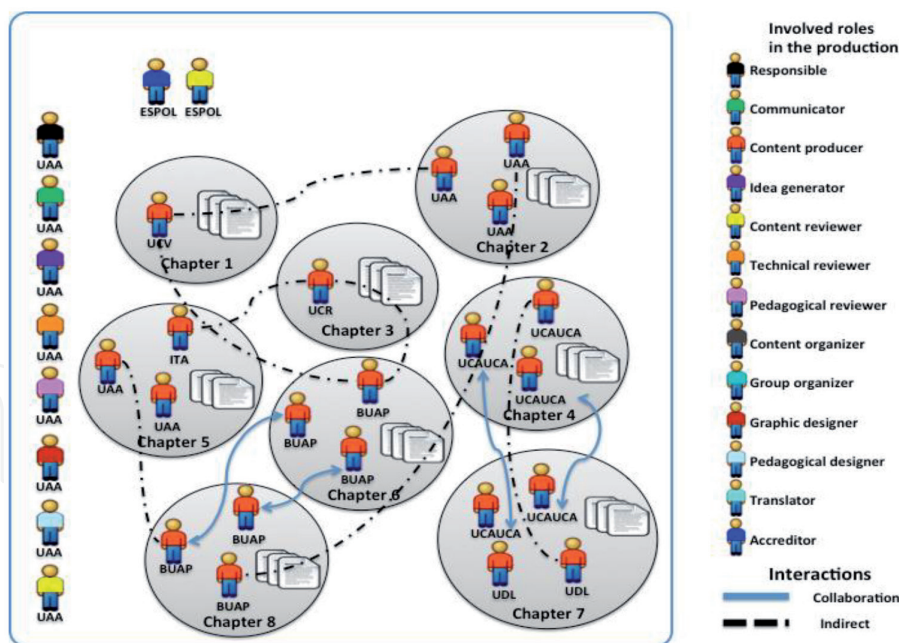
**Figure 4** shows several professors and researchers of different HCI; they were members of an HCI writing group, thanks to the collaborative tools available. In addition, we defined a first title about the proposal and some ideas as a part of first process iterations, being consisted in whole writing group information’s HCI textbook.

On the other hand, **Figure 5** shows the color-coded roles of the actors: the general manager is represented in brown, the communicator in green, the idea generator in purple, etc. The different parts of this structure can be assigned to one or more authors as a coordination process for writing. Author “A” can work or comment anywhere in the document, while author “B” is allowed to read just any part of a chapter, and author “C” cannot see that the rest of the document has not been assigned. However, the teachers participating in the book of HCI held different roles. **Figure 5** also illustrates the distribution of set chapters of HCI book as a result of interactions and collaborative activities of authors.

Then, the specific process to produce the HCI textbook is composed of four phases according to the proposed model of **Figure 2**. In the first phase a call for participation was proposed for the collaborative teamwork among HCI teachers of several higher education institutions who want to have educational resources such



**Figure 4.**  
*HCI writing team in the Latin platform.*



**Figure 5.**  
*Diagram of collaborative production by teachers from several universities of Latin America.*

as textbooks. The second phase starts with the reception of book proposals by the defined collaborative work groups; these groups through social interactions define the theme on which they will create their contents and make contributions on ideas that will be useful to them through the use of chats, forums, messages, discussion groups, etc. The third phase is the production process of open textbooks. Once the collaborative team has the green light to create a proposed book, then it is possible to use of synchronous and asynchronous tools and activate the functionalities that provide collaboration services for an appropriate work, for example, text editors, review templates, and communication tools. Examples of these last tools are chats, mails, blogs, forums, resource sharing, ideas, etc.

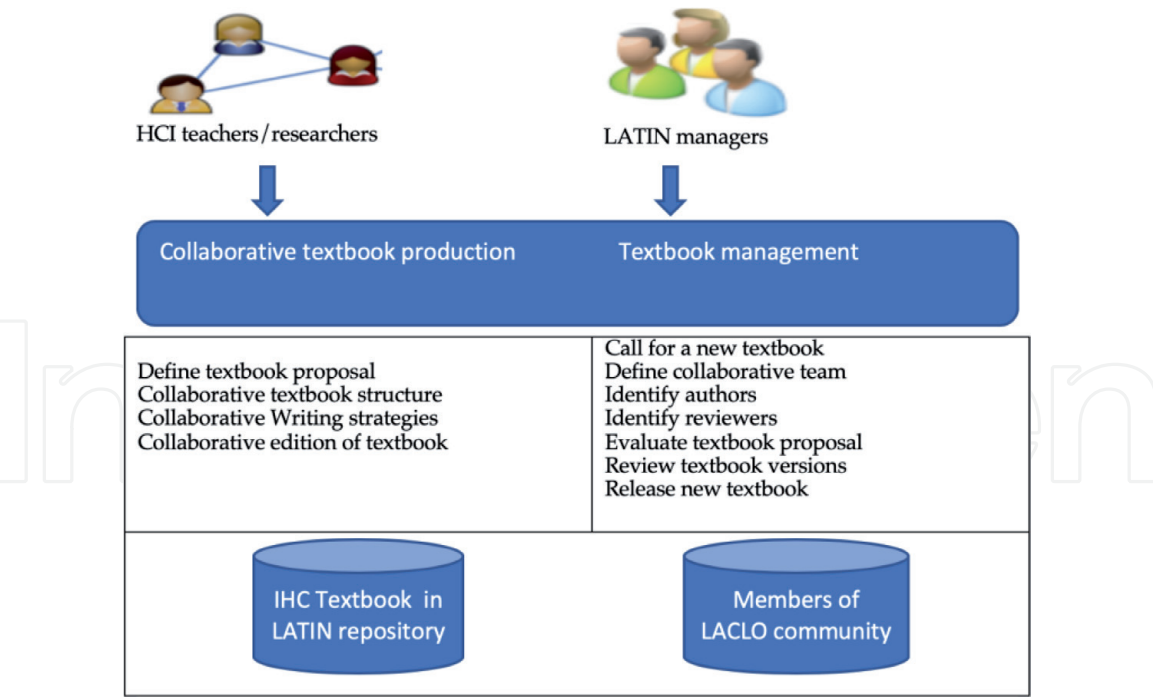
The evaluation of open textbooks is the fourth phase. Once the textbook is complete, it will be submitted to an evaluation process where a technical evaluation is carried out. The reviewers and members committee have used this platform to make technical evaluation about the proposed books. After the technical evaluation, a resolution of acceptance or rejection of the proposed textbook is issued. It recognizes also the authorship of the collaborative team members. Finally, the open textbook is released under an online version.

## 4.2 Services

The technology of service-oriented architecture [12, 13] was exploited to identify several web services to support the main process of the collaborative production of an HCI textbook such as collaborative textbook production and textbook management (see **Figure 6**). The web services for the first process are as follows: defining textbook chapters, collaborating textbook design, planning meeting, and collaborative edition of textbooks. The second process of textbook management is supported by the web services: call for a new textbook, define collaborative team, identify authors, identify reviewers, evaluate textbook proposal, review textbook versions, and release new textbook.

In this case study, the collaborative production of educational resources is concreted in the repository of HCI textbook from the Latin project. In addition, the participants in the HCI webinars become members of the LACLO community [14].



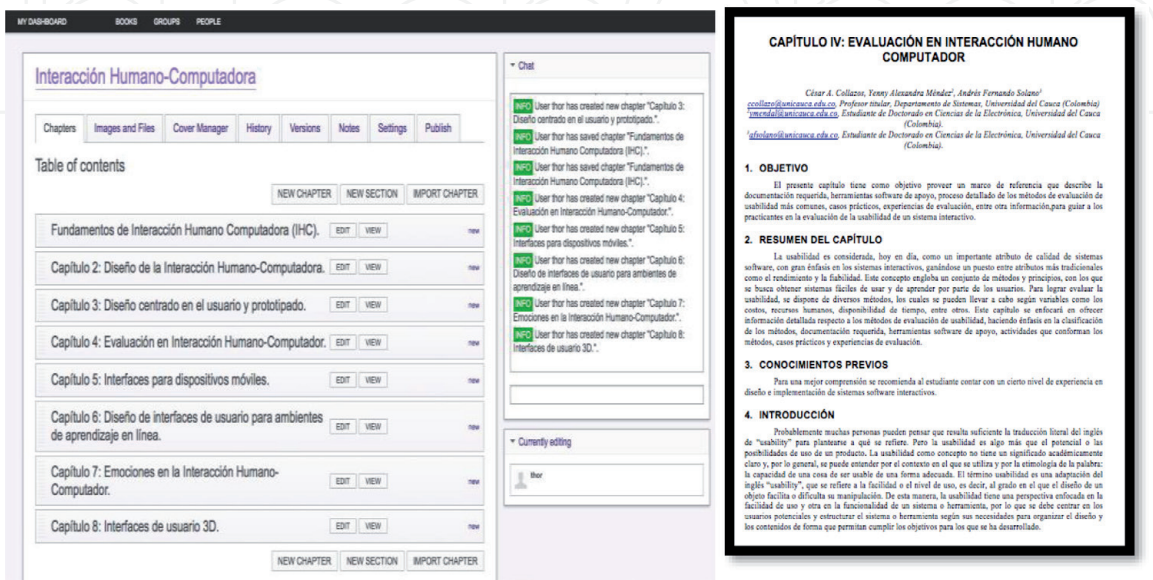


**Figure 6.**  
*Web services for collaborative production of HCI textbook.*

4.3 Repository

A repository for textbook was built where the HCI book is located. The HCI textbook [11] is composed of a set of important chapters such as the foundations and specialized topics in HCI, including chapters about design, development, and evaluation of interactive applications (see **Figure 7**). The book can be used as a basic support of a study material for HCI courses at both undergraduate and graduate levels.

The structure of the textbook consists of several elements that are common among the publishing features of a printed book, such as the cover, foreword, preface, introduction, etc. The different parts of this structure can be assigned to one or more authors as a coordination.



**Figure 7.**  
*List of chapters from the HCI textbook [11].*



5. Collaborative production of HCI web seminar

Another strategy to expand the dissemination of HCI in the Latin American region is to invite academics, professionals, and researchers from HCI to publish their research topics through a webinar (“web” more “seminar”), where they will be able to present and share their experiences, projects, and research in HCI to direct a large number of stakeholders from students, entrepreneurs, and academics and researchers themselves [15].

Among different social media technologies, the webinar is increasingly recognized and used throughout the world; in the context of Latin America, it has as one of its main advantages the possibility of effective communication between people from different geographical places. This facilitates the attendance at conferences and events from anywhere in the world, both in real time and also in deferred. For example, the HCI webinars (see **Figure 8**) have been recorded in the channel Facebook HCI-Collab [16], so the user can watch, download, and share the webinar online.

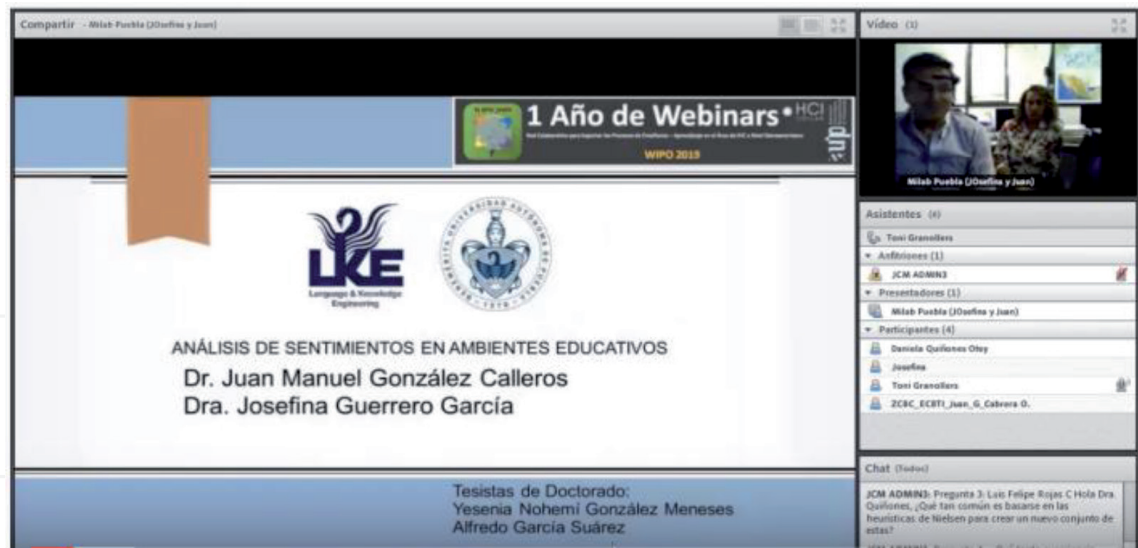
5.1 Collaborative applications

Adobe Connect [17] is the platform to use to transmit HCI webinars given their availability at no cost. It also allows management space for coordinators, moderators, and the speakers themselves. The platform allows you to share files and has screen views and also a chat. In addition, the number of participants is not limited, so the scope of the webinar may be greater. At the same time, you can choose between doing a public conference and doing it only for a specific group, something that can be interesting. **Figure 9** shows an initial section of HCI webinar about feelings analysis in educational contexts by Benemerita Universidad Autonoma de Puebla (“BUAP”) researchers from Puebla, Mexico.

In addition, conducting webinars means presenting webinars in which communication can be in both directions, where communication is first from a speaker and then remote assistants can participate via the Internet. As in any conference, in the



Figure 8. Facebook and HCI collaboration showing several HCI webinars during the year 2019 [16].

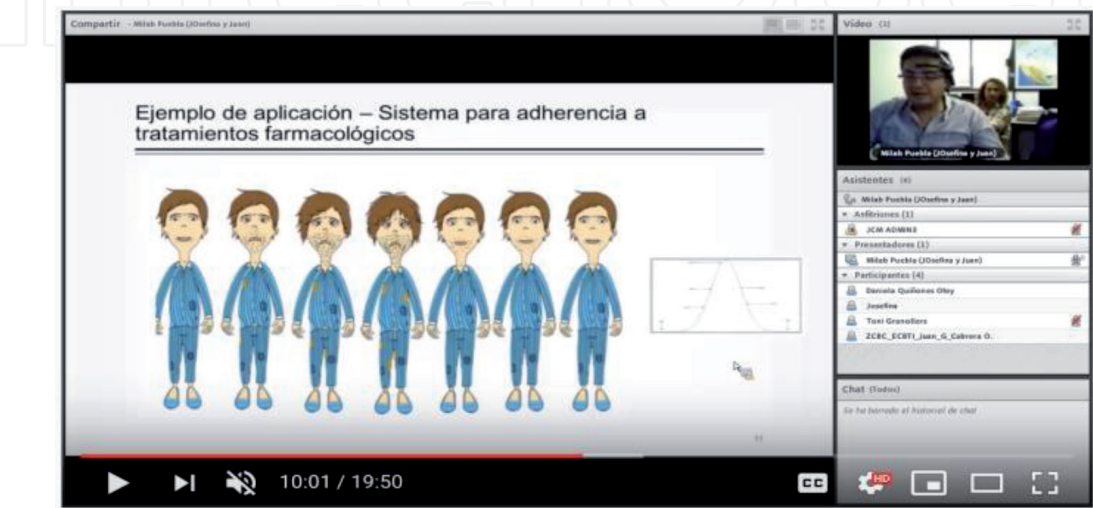


**Figure 9.**  
*Initial section of HCI webinar about feelings analysis in educational contexts using the Adobe Connect [17].*

webinars the user can use a visual presentation (e.g., a PPT presentation), an audio presentation, and/or also a video from the presenters. Throughout the conference, they can communicate through an open chat window to ask questions to the speakers. The resources that the speaker can provide, such as documents, simulations and applications, among others, may also be available during and after the webinar.

**Figure 10** shows examples of avatars about feelings in educational contexts by BUAP researchers. With Adobe Connect, it is possible to share it through the direct URL or insert it in a blog post. The user can invite others from the contact list; but in any case, they will be notified automatically when a public webinar is created.

A planning phase was developed in order to ensure and synchronize the webinar's organization efforts; it will be necessary to carry out a series of tests, as well as agree on the date, the start, the duration, and the topic of interest, HCI (one or two topics maximum). Once all this previous information has been determined, in the second phase (design phase), it is communicated by mail and/or by social networks on topics interested in HCI in Spain and Latin America such as the AIPO network and the HCI-Collab itself. It is in the third phase (construct phase) where the speaker carries out his presentation about HCI through the webinar platform; a moderator will be aware at that time not only to facilitate the activities of the presenter but also



**Figure 10.**  
*Avatars of HCI webinar about feelings analysis in educational contexts of Adobe Connect [17].*

to attend to the management of activities of the online audience, such as confirming communication to attendees and recording your concerns, questions, and comments. Attending to the participants' questions is important because if several have the same question or concern, it can be resolved at once and live. In turn, this will cause the participants to provide feedback to the comments and questions of the other attendees. This avoids massive emails and wasted time answering similar questions. In the evaluation phase, the academic resources that accompany each webinar, such as practices, interactive applications, transparencies, and the conference itself, will be available through the online repository of the HCI-Collab network. Other resources can make up the collection of the repository such as conversation forums, topics of interest, and collaborations that are based on the theme of the given webinar. It is important to indicate that attendees can contribute and share their own experience by participating as a speaker in one of the webinars to be carried out.

For example, the Facebook HCI-Collab video channel (see **Figure 8**) allows the recording of each seminar for later publication, thus speeding up the online video production process of an HCI theme to be available immediately at the end of each seminar. Each time a webinar is carried out, it requires covering a process that generally helps to organize the participants and display the presentation and distribution of the learning resources in HCI. Thus, the process is composed of four stages according to the proposed process model in **Figure 2**.

## 5.2 Services

The technology of service-oriented architecture [12, 13] was also exploited to identify several web services to support the main process of collaborative production of HCI webinars such as HCI webinar production and HCI webinar management (see **Figure 11**). The web services for the first process are as follows: prepare content for HCI webinar, make previous tests for an HCI webinar, give conference of HCI webinar, and answer questions from the audience. The second process, HCI webinar management, is supported by the web services: call for a new HCI webinar, accept an HCI webinar speaker, identify the speaker, introduce the speaker, get questions from audience, and publish a new HCI webinar.

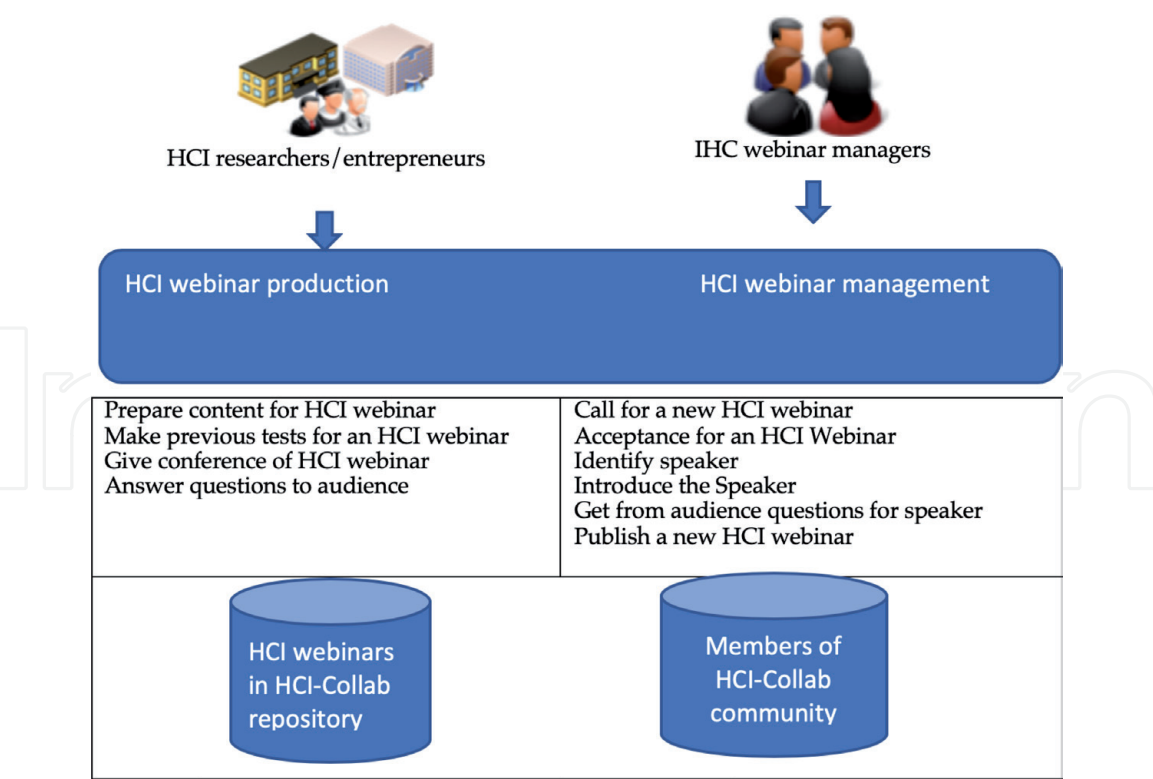
In this case study, the collaborative production of educational resources is concreted in the repository of HCI webinar from a website HCI-Collab. In addition, the participants in the HCI webinars become members of HCI-Collab community [15].

## 5.3 Repositories

The initiative called "One year of HCI webinars" [15] helps to produce HCI educational resources in order to obtain a repository as extensive as possible online and free of charge on various topics related to HCI in Spanish. They are short-lived webinars under many topics. Something that we have been doing regularly, that is natural to us. The webinar has as its main interest topic, teaching HCI, mainly in the university field; all initiatives offered by companies, or other entities or groups, are also welcome.

The digital resources, as well as the experiences and successful projects presented in the webinar, can be capitalized under a platform as a collaborative network website to support the teaching-learning processes in the area of human-computer interaction at the Ibero-American level, HCI-Collab, a website that helps meet training and updating needs in the HCI area in the region (See **Figure 12**). The proposal was feasible in the event that each of the members of the HCI-Collab community reaches at least one webinar, during a year; a large amount of material was obtained with a fairly low collaborative effort. This repository represents a training corpus that can be used to complement HCI teaching.





**Figure 11.**  
*Web services for collaborative production of HCI webinars.*



**Figure 12.**  
*Website for the initiative One year of HCI webinars [15].*



In addition, the Facebook HCI-Collab allows also the recording of each seminar for later publication, thus speeding up the online video production process on an HCI theme to be available immediately at the end of each seminar (see **Figure 8**). Each webinar can be shared through the direct URL or inserted into a blog post, and specific contacts can also be invited; but in any case they will be notified automatically when a public webinar is created.

## 6. Conclusion

This work proposes the use of a model for the collaborative production of online educational content in the area of human-computer interaction. The model encourages the multidisciplinary collaboration to produce and share the use of online HCI educational resources. The proposed model has been applied first to develop a textbook in HCI by several professors from universities in Latin America. The proposed model was applied for the collaborative production of open textbooks, considering the use of online services for the creation, adaptation, and mix and reuse of open textbooks. In addition, it considers strategies for the implementation and adoption of the initiative for such textbooks. This model was implemented also for educational resources in terms of a series of webinars, which are offered to the Latin American community as a means of obtaining and accessing learning and reference resources in Spanish in the discipline of human-computer interaction. The initiative is proposed as a strategy to promote knowledge about various HCI issues, which will be presented by renowned Latin American researchers and entrepreneurs. It is expected that this initiative will strengthen the HCI-Collab network and allow the entry of new members. In itself, the objective of the initiative to be achieved is twofold because, on the one hand, it is intended to contribute to the generation of educational resources in the HCI area and, on the other hand, to help in the formation of communication mechanisms between professionals and academics. As a final conclusion, it can be said that carrying out the HCI webinars for a year will favor new forms of organization and participation, allowing the emergence of new collaboration scenarios in which you can attract, manage learning, and increase knowledge, which they have added value for professionals and organizations.

Several subjects to study are considered here as future work, in particular the study of user satisfaction and the development of better services [18], to access the HCI educational content to cover a major number of communities in Latin America.

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