

Food and health: a vision from the curricular design of the Bachelor of Food Sciences

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Abstract

The training of professionals to obtain a Bachelor's Degree in Food Science requires the development of biomedical science information management skills. This study proposes the curriculum design of an elective course and its integration with the Information and Communication Technologies (ICT). This design was developed based on the professional model and includes the concept of curriculum integration of ICT expressed in a curriculum planning, so that its use responded to educational needs and demands. The programs *Wordpress* and *eXeLearning* were used for the preparation of the materials in Web format and the elaboration of *Edublog*. **Conclusions:** The designed and implemented resources form a system of integrated means and are comprised of chapters in electronic format, a web course, an *Edublog* and a monographic product on the impact of sugar consumption on health. Motivation, management and evaluation of scientific information were achieved.

Keywords: ICT; curriculum design; Edublog; didactic media system

Alimentación y salud: una visión desde el diseño curricular de la Licenciatura en Ciencias Alimentarias

Resumen

La formación de profesionales de la Licenciatura en Ciencias Alimentarias requiere del desarrollo de habilidades en la gestión de información en ciencias biomédicas. El presente trabajo propone el diseño curricular de una asignatura optativa y su inte-

gración con las Tecnologías de la Información y las Comunicaciones (TIC). Este diseño se conformó a partir del modelo del profesional, y contempla el concepto de integración curricular de las TIC expresada en una planificación curricular, de forma que su uso respondió a necesidades y demandas educativas. Se utilizaron los programas *Wordpress* y *eXeLearning* para la realización de los materiales en formato Web y la elaboración del *Edublog*. Los recursos diseñados e implementados son un sistema de medios integrados y comprenden capítulos en formato electrónico, un curso web, un *Edublog* y un producto monográfico sobre el impacto del consumo de azúcar en la salud. Se logró la motivación, gestión y evaluación de la información científica.

Palabras claves: TIC; diseño curricular; *Edublog*; sistema de medios didácticos

Alimentação e saúde: uma visão do desenho curricular do Bacharel em Ciências da Alimentação

Resumo

A formação de profissionais do curso de Graduação em Ciências da Alimentação precisa do desenvolvimento de habilidades na gestão de informação em ciências biomédicas. Este estudo propõe o desenho curricular de uma matéria optativa e sua integração com as Tecnologias da Informação e as Comunicações (TIC). A conformação deste desenho partiu do modelo do profissional e prevê o conceito de integração curricular das TIC expressas em um planejamento curricular, de forma que seu uso respondeu a necessidades e demandas educativas. Para a realização dos materiais em formato Web e a elaboração do *Edublog* utilizaram-se os programas *Wordpress* e *eXeLearning*. Os recursos criados e implementados compõem-se de um sistema de meios integrados e abrangem capítulos em formato eletrônico, um curso web, um *Edublog* e um produto monográfico sobre o impacto do consumo do açúcar na saúde. Obtiveram-se a motivação, gestão e avaliação da informação científica.

Palavras-chaves: TIC; desenho curricular; *Edublog*; sistema de meios didácticos

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The high morbidity due to chronic non-communicable diseases evidenced in Cuba and the world, particularly those related to diet, is a very current social problem. There is a wide range of research carried out by different sciences, in particular Food Science, which focus on the prevention of these diseases through the consumption of plant-based foods (Amiot, Riva, & Vinet, 2016; Boeing et al., 2012; Chiva-Blanch, Badimon, & Estruch, 2014; Santesso & Manheimer, 2014; Sofi & Dinu, 2016). According to the WHO, regular fruit and vegetable consumption has been associated with a lower risk of chronic disease and mortality (Oyebode, Gordon-Dseagu, Walker, & Mindell, 2014; Wang et

al., 2014).

The abovementioned issues have driven the advancement of research in nutritional sciences and the incorporation of new multidisciplinary approaches (Guardado et al., 2017; Hoensch & Oertel, 2015). In turn, this new knowledge has generated the need to incorporate new content to the teaching-learning process (TLP) in higher education, and thus it has contributed to the training and updating of professionals in this field.

Food is the scope of work of the graduates from Food Science in Cuba, representing the element of the reality on which the professional activity focuses directly (Lantero, 2010). In this program, food is

defined as a complex food matrix, formed by a great chemical-structural heterogeneity of diverse components, called nutrients and non-nutrients, among other characteristics. The core and specific curriculum of this program is designed in such a way that the courses that address the biomedical field of action focus on the macro and micronutrients of food and their relationship with deficiency diseases, while the compounds classified as non-nutrients (carotenoids, polyphenols, etc.) are studied to a lesser extent, which is evidenced in the analytical content of the courses belonging to the Food and Nutrition discipline (Cardona et al., 2017; Lantero, 2010).

However, there is a large amount of information about non-nutrients published in biomedical journals on the Internet, which can be used in teaching. On the other hand, observations made in teaching practice have proved that students in this program lack the tools and methods to access such scientific information. In view of this, the need for them to develop skills to manage and contrast scientific information published in primary web sources has been identified (Cardona et al., 2017). The way forward may be to design a curriculum that adequately integrates the use of ICTs (J. Sánchez, 2003) adapted to the Cuban context.

Curricular design for Higher Education is a system of actions, mechanisms, and formulations for a specific profession, which, at a given time and place, allows to elaborate and materialize the objectives of a training process, thus responding to a social and individual need (Fuentes-González & Álvarez-Valiente, 2002). During this process, special attention should be paid to the development of teaching materials and the advantages offered by ICTs, and thus to the shaping of a system of teaching aids (Castañeda, 1997).

There are many challenges facing Higher Education in Cuba, including training professionals according to social and work demands, so that they can be successful in their professional activity (Lantero, 2010). For these reasons, training professionals for changing times is a social necessity. The continuous updating of these professionals requires new teaching-learning situations and new models adapted to it. It has been suggested that the problems in today's curriculum design may cause problems in solving the social needs of tomorrow (Cabrera, Crespo, & Portuondo, 2017).

In this sense, the correct use of ICTs suggests the following question: How may the potential of ICTs and networks be used in the training process to maintain an updated and continuous education? Although the university education system cannot teach specifically for every need, it may train future professionals to be flexible, effective, and autonomous lifelong learners. Under these considerations, the design of new courses part of the elective curriculum of this program constitutes an area of development. Therefore, elective courses that contribute to the resolution of professional problems in the biomedical field have been designed in this program. These courses are of great importance in the development of competencies related to the field of dietetics and diet therapy, and the development of research associated with the treatment and prevention of diseases. The hypothesis proposed is the development of educational media supported by ICTs as part of the curricular design of an elective course. This initiative will motivate students and bring them up to date scientifically and technically on topics related to food and to its components and health benefits, in the Cuban computerization environment.

The objective of this paper is to describe the curricular design elements of an elective course contextualized in the Cuban context, emphasizing a system of educational media that reflect its curricular integration with ICTs, and which have been developed by faculty members and student assistants of the Food Science program.

State of the Art

The curricular design of the proposed elective course was based on the model of the professional graduated from the Undergraduate Program in Food Science in Cuba (Universidad de la Habana, 2018). It was based on the system of core objectives and skills of the Food and Nutrition discipline defined in that model. It also considered the concept of ICT curriculum integration expressed in a classroom curriculum planning, so that it responds to the educational needs and demands stated in the Program Educational Strategy (Reparaz, Sobrino, & Mir, 2000).

This research emphasizes the characteristics of the educational resources designed and supported by ICTs, as a novel element that will be used for the first time in the discipline to which the course be-

longs. A series of actions were taken, which contributed to the design of the elective course in order to achieve the curricular integration of ICTs (Table 1), based on the Holistic Configurational approach, its adaptation to the training process, and the integration of ICTs proposed by Fuentes-González & Álvarez-Valiente (2002).

The following aspects had to be carefully considered in the preparation of teaching aids and their contents:

- a) The adaptation of the media use to the Cuban infrastructure and context, for which the following elements were important in the design:
- i) The search for and evaluation of resources available on the Internet that can be accessed from Cuban conditions and that would integrate the updated bibliographies, ii) the definition and design of new resources and materials to support the Educational Teaching Process (ETP) based on ICTs.
- a) Selection of scientific literature: Information that was recent was selected and searches in the English language were included. The content of the bibliographic materials incorporated to the course were consulted in the main international databases that index high-impact journals, such as *Web of Science* and *Scopus*, which work as citation indexes. In addition, information was managed at *Pubmed*, which specializes in biomedical content. Access was done through the Google Academic search engine and the *EndNote* bibliographic management program. Some of the main themes of the recovered articles were: i) The possible antimicrobial and antioxidant effects of bioactive (non-nutrient) substances present in plant-based foods, ii) types of existing evidence on the beneficial role of non-nutrient bioactive compounds present in plant-based foods, and iii) elements related to their chemical structure and bioactivity.

Table 1.

Methodology Used in the Design of the Elective Course and Its Curricular Integration of ICTs

Phases	Objectives	Examples of actions taken
Phase 1. Defining the macro and micro-curricular design of the	To study the program characteristics of an elective course in curriculum D	<ul style="list-style-type: none"> • The objectives, contents, methods (learning strategies, collaborative work, computer-mediated communication, others), and their evaluation system and teaching task supported by ICTs were defined. • The use of ICTs in the Food and Nutrition discipline that methodologically define the course was reviewed. • Alternative solutions were projected in view of the possible limitations of ICT integration, under the available infrastructure conditions.
Phase 2. Developing the System of Educational Media supported by ICTs	To develop contextualized and ICT-supported learning resources	<ul style="list-style-type: none"> • A search for and evaluation of the resources available on the Internet to be used in the course was carried out. • New ICT-based resources and materials supporting the TLP were designed and developed. • A group of software was used to create materials in Web format: a) <i>Wordpress</i> which allowed the creation of the <i>Edublog</i>, b) the <i>eXeLearning</i> program, which allowed the preparation of the optional course and the monographic product. • Within the discipline group, the communication tools to be used were assessed based on the use of the assumed technology, as well as the integral conception of their use and definition of the moment and educational function of each one of them.
Phase 3. Impact on students after the use of the ICT-based media employed during the elective course	To obtain feedback from the trainees after the course has been delivered	<ul style="list-style-type: none"> • Alternative solutions were projected in view of the possible limitations of ICT integration, under the available infrastructure conditions.

This research work shows an overall characterization of an optional course's curricular design, which aims to incorporate emerging contents of nutritional sciences absent in the curriculum, as well as the assessment made by faculty on the motivational impact, advantages, and disadvantages of the designed media, in the analyzed context, after teaching the course for the first time. This was supported by observation, evaluation results, and NIP assessment shown by the first 22 trainees and the two student assistants.

Macro and Micro Design of the Elective Course (Phase 1)

Curricular design is the creative process that precedes all educational action, where the curriculum is planned and conceived, applying a theoretical-methodological conception to a concrete educational reality that may be a university program, a discipline, or a course, taking into account the need for the curriculum to contemplate, in addition to what is proposed, the dimensions of extensibility, flexibility, change of roles and interactivity (Fuentes-González & Alvarez-Valiente, 2002)

Curriculum D of the Food Science program presents a set of courses of biomedical nature grouped in the discipline called Food and Nutrition. Upon studying the characteristics of an elective course content in curriculum D, it was determined that some of the subjects kept since the previous curriculum are nutrition, dietetics, bioethics, among others (Universidad de la Habana, 2018). However, the elective curriculum of Universidad de Camagüey has provided a space for designing new courses aimed at the scope of action of nutrition and dietetics (Gaceta Oficial, 2007; Universidad de la Habana, 2018). The optional course "Food and Phytochemicals" was proposed to be taught in the second academic year, as part of the regular daytime program. The following are some essential aspects of its design as stated in the analytical program prepared for this course:

- *Course basis:* This course studies the interaction of food with humans, and the social projection of this relationship. Specifically, it focuses on the classification and structure of phytochemical (bioactive) compounds present in plant-based foods, relating them to the clinical evidence associated with the prevention and

treatment of chronic diseases. This is based on knowledge of the chemical structure of organic compounds, the morbidity and mortality of chronic diseases that characterize Cuba and the world today, and the appropriate selection and interpretation of scientific evidence published in high-impact biomedical journals.

- *Course characteristics:*
 - *Problem:* The need to study in an integrated way (in an educational unit) the presence of phytochemical compounds in food and the benefits they may present as bioactive compounds against chronic non-communicable diseases.
 - *Purpose:* Phytochemical compounds present in foods, to obtain an overview of their health benefits.
 - *Objective:* To apply, at a productive level, the principles of the basic sciences, in the knowledge of the structure and chemical properties of the phytochemical components of vegetable foods as a way to interpret the transformations that products suffer in the organism itself.
- *Methodological and organizational indications:* The knowledge and skills acquired in this course will bring students closer to the most current scientific evidence on the role of phytochemical compounds present in plant-based foods and their beneficial relationship with the prevention of chronic diseases that characterize Cuba and the world. This is a theoretical course, which places great importance on mastering all the class typologies of the scientific information published in papers of high-impact biomedical magazines, both in Spanish and in English. In order to fulfil the foreseen objectives, the theoretical aspects should be supported by graphics, videos, slides, and educational guides, in order to make adequate use of each of the resources based on the ICTs that have been developed especially for this course. The independent work of students should be promoted through the search for scientific information and the discussion of results.
The contents were divided into two topics (Figure 1) that have as an invariant the skills of managing scientific information in reliable bibliographic sources. The criterion for selecting papers

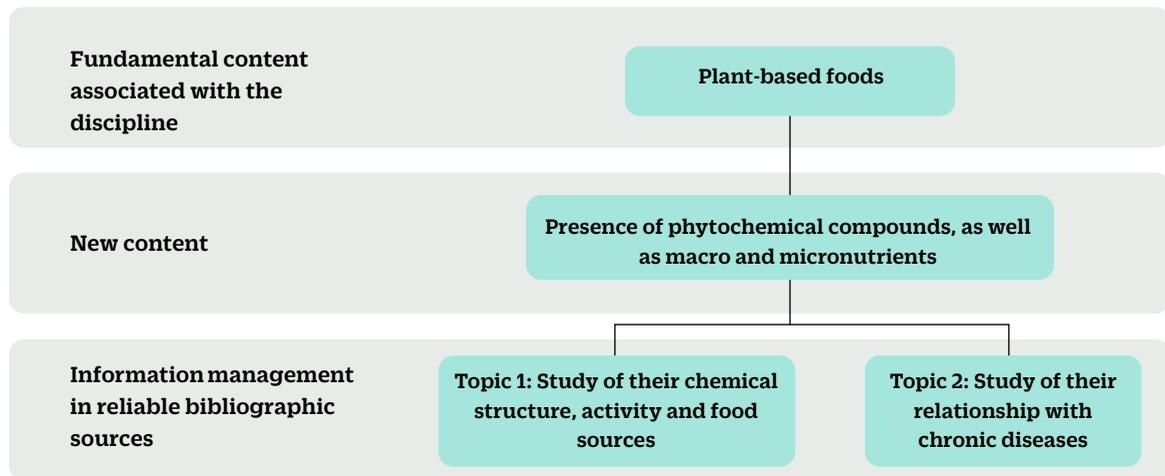


Figure 1. Subdivision of the topics of the “Food and Phytochemicals” subject

was to include those published in high-impact biomedical journals, preferably in English. The review regarding the use of ICTs in the different courses that make up the discipline determined that this skill has been poorly systematized.

Relationship Among the Volume of Scientific Information - Methodological Alternatives

This research work considers that the educational approach on the benefit and damage of plant-based food consumption must take into account the current scientific evidence, and that allows to strongly correlate a potential beneficial relation (Amiot et al., 2016; Chiva-Blanch et al., 2014; Santesso & Manheimer, 2014; Sofi & Dinu, 2016). Due to the novelty of this topic, it is not possible to adopt a single position on the critical analysis of a scientific paper. It is necessary to teach that the process of searching for scientific information must consider the reliability and updating of bibliographic sources, as it is recognized nowadays (Rodríguez, Simões, Freitas, & Frías, 2017)

For discovering new scientific information, Google tends to be prioritized (Rodríguez et al., 2017). Nicholas et al. (2017) point out that this preference may be explained by the ease of its search, given its simplicity, as well as the increasing availability of full texts and free-access scholarly information (Nicholas et al., 2017). Schonfeld (2015) presents similar results, as he states that Google and Google Scholar are very relevant access points

to information (Schonfeld, 2015). As the access to these search engines is possible in the Cuban context, they are part of the recommendations for a Search Strategy. Sometimes, students preferred academic content in open access because of the advantages it offers to Latin American countries (Salazar, 2015), as well as access to scientific information indexed in databases such as Scielo and Latindex.

In other contexts, Gardner and Inger (2016) emphasize that bibliographic databases, such as *Web of Science* (WoS) and Scopus, remain as the main sources for the discovery of scientific information (Gardner & Inger, 2016). On the other hand, PubMed Central is one of the favorites for biomedical sciences (Rodríguez et al., 2017).

As part of the elective course design, the potential level of impact of the ICT integration was projected given the infrastructure available (connection speed, number of computers per student, among others), generating solutions to overcome these limitations and facilitate the desired integration of ICTs. Because the connection speed from Universidad de Camagüey to the journals contained in these databases is slow, the faculty members retrieved information in advance to be used as bibliographic material, which was consulted in independent study activities.

On the other hand, it is interesting to highlight the importance of guiding in the teaching practice the process of contrasting published scienti-

fic information on this particular nutrition issue, because epidemiological studies are still required to establish convincing associations between the intake of non-nutrients and their benefit. All of this is presented in a context where large food corporations sometimes “promote health” and “label certain foods as healthy” long before science reaches conclusions in this regard. It is equally significant to contribute to nutrition education activities with scientific evidence, which is of great importance in food security, community nutrition, and health interventions (FAO, 2011).

The basic content of this elective course is closely related to the concept of a healthy diet, which is achieved, as indicated by Izquierdo, Armenteros, Lancés, & Martín (2004), combining several foods in a balanced way, and thus satisfying the nutritional needs. All of this will contribute to the correct growth and development of physical and intellectual capacities (Izquierdo, Armenteros, Lancés, & Martín, 2004). Therefore, the benefit of non-nutrients is significant in meeting the challenges of today's nutritional science.

Based on the grades obtained in the first teaching of the course, the achievement of the systematization in the information management, critical analysis, and adopting a posture towards scientific evidence skills was observed, as skills that are currently required by this type of professional. It has been suggested that current science is characterized by the loss of certainty, not only in the social sciences, but also in the exact sciences. Nowadays, education must help students to develop their own point of view, their own truth based on so many partial truths (Fuentes-González & Alvarez-Valiente, 2002).

The ICT-based teaching aid system of the elective course consists of various technological alternatives (tools) such as a teaching guide, which in turn contains the guidelines for seminars. The latter, as a class organization form, contribute to the exposure and exchange of ideas in the group. Through this system, the professor conceived how the student can transform the large volume of information into knowledge, skills, and values, while developing guidance strategies for students to decode the information they find on the web.

It is well known that the emergence of ICTs as an educational tool represents a conceptual and

methodological turning point in the way in which university institutions deal with educational processes and learning management (García-Peñalvo & Pardo, 2015). As a consequence of the above and of deeper cultural changes, we are also living in a multiple-knowledge society. We must not assume absolute points of view but accept the diversity of perspectives, with the relativity of theories, with the coexistence of multiple interpretations of all information, and learn to build our own judgment or point of view based on them. All this allows us to identify the importance of ICTs in the process of professional training (Gargallo, 2018; González, Tovilla, Juárez, & López, 2017).

Overview of ICT-Based Educational Media Design and Their Use in the Course (Phases 2 and 3)

One of the aspects to be addressed during a new design is the identification of the educational media to be used. It is necessary to identify the basic and complementary bibliography, and it is also suggested to prepare educational guides oriented to student learning (García, 2009). The entire media system can be supported by ICTs, which brings different advantages to today's education. In turn, the need to integrate ICTs into the curriculum arises, which implies integrating them into the educational principles and didactics that make up the gears of learning (J. Sánchez, 2003; Vásquez & Martínez, 1997). Several authors point out the importance of defining certain requirements for integrating ICTs to the curriculum, such as i) that the curriculum should guide the use of ICTs and not that ICTs should guide the curriculum (Dockstader, 1999); ii) a shift from a conception centered on ICTs to a conception of learning by using the ICTs (Fernández, Carballos, & Delavaut, 2008; J. Sánchez, 1998); iii) that skills required/developed in the use of ICTs should be directly related to the content and tasks of the class (Dockstader, 1999).

The characteristics of each of the media that were designed are shown below, as well as those advantages that they can offer, according to the analysis of the faculty and the opinions of the students, after teaching the course for the first time:

a) Design of the Course in Web Format:

The structure of the course in the Web format was defined by two fundamental themes and five

educational units. An educational unit is understood as a work proposal related to an articulated and complete PEA (Romero-Granado, 2004). Therefore, it is an instrument for planning educational tasks. The designed course includes a group of independent study activities, which allows the interaction with this material and facilitates self-learning and collaborative learning, as evidenced by the conducted assessment. There is an articulation between the planning of the independent study activity system of the courses and the program in this format, where face-to-face activities play the main role in aspects related to student-professor negotiation that, in turn, are intentionally aimed at increasing values such as responsibility, professional ethics, and collaborative work.

The implementation of the elective course in Web format using *eXeLearning*, allows to evidence motivation by the students. *Figure 2* shows some of the advantages offered by the course supported in this Web format, which were pointed out by students and faculty members. When compared with other courses in the same discipline (but without ICT-supported teaching aids), students identified attractive design, enjoyable introduction, friendly writing style, opportunities for interaction with the material, and reasonableness of the length as positive and interesting elements. This teaching experience clearly shows that these aspects contributed to an evident interest from the students in the course. Some of these elements have been previously pointed out by Orea (2015).

Figure 3 shows some slides contained in the Web course corresponding to different lectures, where special attention is paid to the advantages in terms of image placement offered by the media, and which were pointed out after the self-preparation activities for seminars, and which shows positive and interesting evaluations from more than 87% of students.

It is suggested that educational material should always correspond to the objectives (desirable situation). The professor must be clear about what students should learn—whether objectives, competences, skills, abilities, etc.—not only in order to determine the way in which they assume methodological strategies, but also to select a material

that allows the desired situation to be acquired (Dockstader 1999).

b) Generation Based on the Research of Supplementary Bibliographic Material:

The link between faculty teaching and their research allows the generation of new knowledge, which is an added value to the course, and is always well appreciated by their students. In this sense, as part of the research work conducted by this course's faculty members, two chapters were prepared in books whose publishers were internationally recognized scientists, and included the participation of authors of different nationalities (Guardado, Molina, Matos, & Uriarte, 2012; Matos et al., 2015). This bibliographic material constitutes, among others, the supplementary bibliography supporting the course, which is included in the corresponding educational unit. It provides an overview on new approaches to the study of bioactive (non-nutrient) compounds, present in plant-based foods, with antimicrobial and antioxidant activities. Its use as part of the digital resources of the web course has also been valued as a motivational element and positive and interesting criteria in more than 60% of the NIPs carried out.

Qualitative Assessments after Implementing the Elective Course

In this program, each of the elective courses is expected to be announced before its implementation. This is a decision-making process by students, who will select the one they are most interested in studying, according to different criteria such as their motivation or the need to delve into different areas of knowledge. Under this premise, the course's faculty analyzed the possible ways to interest students before their enrollment. They decided to create an *Edublog* (which became a new educational resource of the course), since these are presented, as stated by Durán, 2011; García-Peláez et al., (2012), as an easy and free way to write periodically, personally or collectively, on the internet (or intranet in this context), allowing debate or comments on each of the topics or messages that are proposed. In recent times, the concept of Web 2.0 is widely spreading, and its main feature may be the replacement of the concept of reading Web by the reading-writing Web. Many tools are helping the information production pro-

cesses developed around the Network to be implemented without almost any technical knowledge, and without spending time excessively (Durán, 2011; García-Peláez et al., 2012). Therefore, developing educational events around the Internet (educational Web 2.0), such as *Edublog*, is nowadays a much easier task from the point of view of the ne-

cessary logical resources, so we can make the professor profile prevail over roles closer to the world of Informatics (Cheng, Lehman, & Armstrong, 1991). The scope of technological media when used correctly in the educational process and the importance of the professor performance in the PEA has been proved (Flores & Guzmán, 2015).

<p>It is accessible, allows learning at home.</p>	<p>Allows reusing content to adapt it to new teaching materials.</p>	<p>Allows an easy organization of the topics that will be covered in class.</p>
<p>It can be used as a self-assessment tool.</p>	<p>It offers a friendly environment and allows adding content as enriched text, graphics, animations, videos, and interactive activities.</p>	<p>It allows working in online or offline (with no internet connection) systems, which is useful in the Cuban context.</p>

Figure 2. Main advantages identified by students and professors after the use of *eXeLearning* in the creation and delivery of the Web course

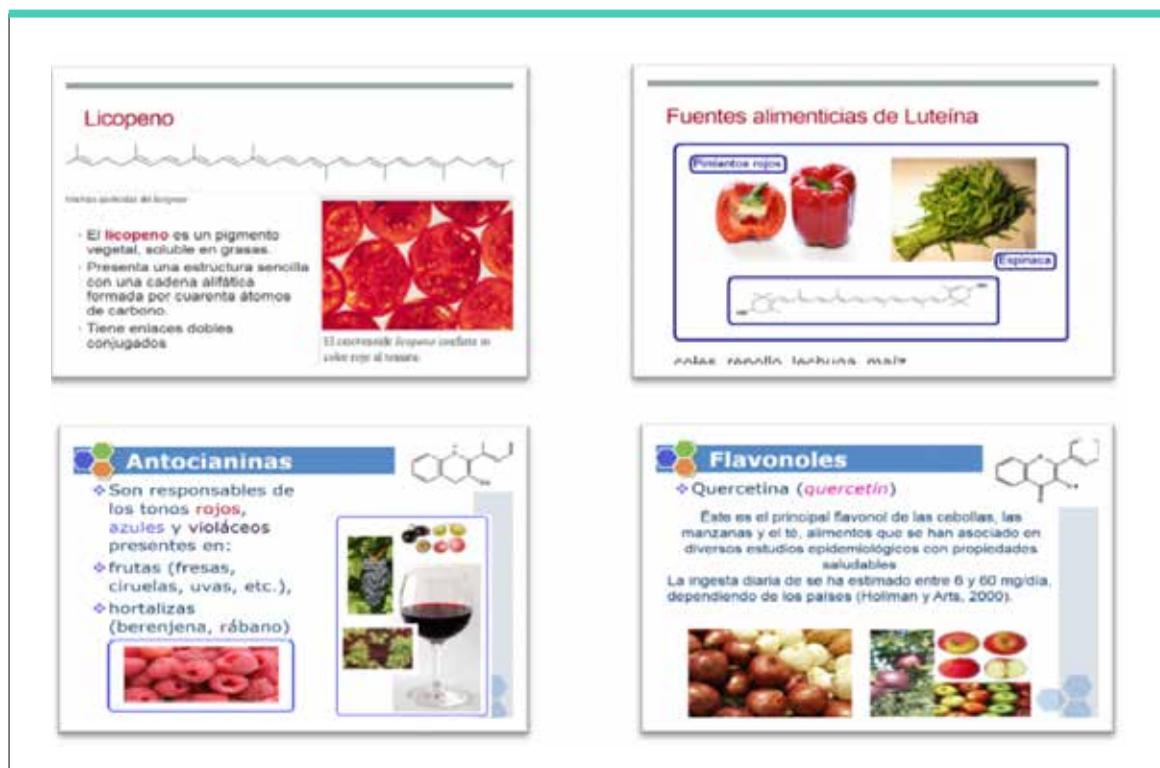


Figure 3. Examples of images that correspond to the course materials in Web format

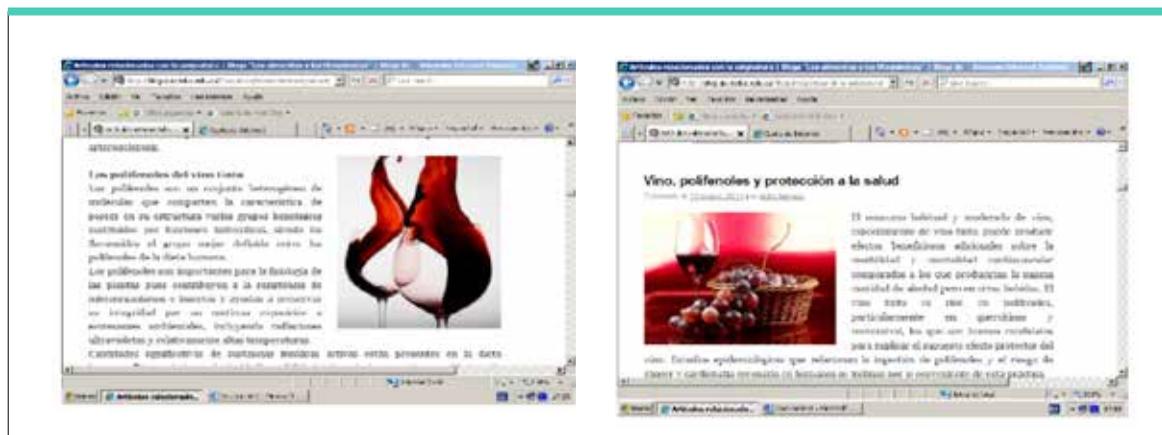


Figure 4. Images from the “Food and Phytochemicals Edublog,” displayed on the university intranet

The design and implementation of *Edublog*, particularly for this course, was carried out in collaboration with student assistants (in the Cuban contexts, these are the students who play the role of the professor under the guidance of qualified faculty members). It was noted that this material allowed for a better exchange of information with the rest of the students and was shared by them in their networks. This *Edublog* including content on the benefits of phytochemicals also aids in facilitating collaborative learning on the web, among other advantages from a pedagogical point of view, as has been agreed by different authors in other contexts (Durán, 2011; Galeana-Victoria, Flores-Azcano, García-León, & Ruiz-Martínez, 2016) Furthermore, *Edublogs* are a valuable tool that may contribute to the construction of meta-cognitive processes (Galeana-Victoria et al., 2016). The *Edublog* developed in this research work constitutes a dynamic application with a pleasant interface and a language according to the current youth, without neglecting the technical terminologies related to the topic (Figure 4), being considered as interesting by 97% of the students in the NIP carried out. Faculty members analyzed that the challenges of its use consist in students using this tool as a learning log to gather useful information, share knowledge with other people, and express emotions and feelings.

Despite the mission of *Edublog* within the course, its use may still be limited to collaborative exchange on the web in the educational context of this research. According to the faculty, the reasons

behind this may be the lack of a computer culture, the restrictions due to the number of computers available per student, and other aspects. The different possible causes are valid to be studied in future pedagogical research in each of the disciplines that make up the program, in order to create a culture in this sense, on the basis that, around the world, *Edublog* has proved to be an interesting way to generate knowledge and propose, discuss, and argue with freedom an idea associated with the topic being addressed. Another result that allows to increase the list of learning objects of the educational media system in this course is the creation of a monographic product implemented in Web format using the *eXeLearning* tool. This monographic product is a result of the motivation achieved during the teaching of the course, and it is developed within the framework of the activities of a student scientific group (GCE, in Spanish) and after the motivation generated after the teaching of two seminars of the course. This product aims at studying the History of Cuba under a local health and food approach. This monograph presents different chapters that relate the History of Cuba to the impacts on health following the high productivity and consumption of large quantities of cane sugar (Figure 5), under a Science, Technology and Society (STS) approach (Montes de Oca, 2018; Vilches, & Furió, 1999). This material was structured taking into account different stages of Cuban history and offers new information on the health impacts of sugar consumption following Cuban eating habits, and the impacts generated

in the world by the high production and marketing of this product. It became a bibliographic reference material for other courses of the program such as Food and Culture, Introduction to Food Science, Nutrition, Dietetics, among others.

Figure 6 shows an example of the interface of the monographic material, and an example of its systematization activities. One of its development perspectives is the incorporation of videos and testimonies that allow us to learn the projections of the current research developed in Cuba, related to the development of new co-products of the sugarcane industry and its potentialities in the design of new types of food for human beings.

It is interesting for the faculty to observe that the *Edublog* product, designed with the aim of motivating enrolment in the course, fulfilled its

objective. However, an unexpected event was that, during the teaching-learning process, a new monographic product was developed, which responded to the motivation for the health benefits of certain types of substances and foods addressed in seminars. In general, when applying the NIP, out of the 96 statements proposed, 51% were positive, 17% negative, and 32% interesting. The most positive aspects highlighted by the students were the collaboration in teams achieved in teaching tasks oriented in the Web course, the possibility of having updated bibliography in the Web course, the review of book chapters created by the professors, and the presentation of the course through the *Edublog*.

The most notable negative aspects were the short time available for the final assignment and



Figure 5. List of items addressed in the monograph

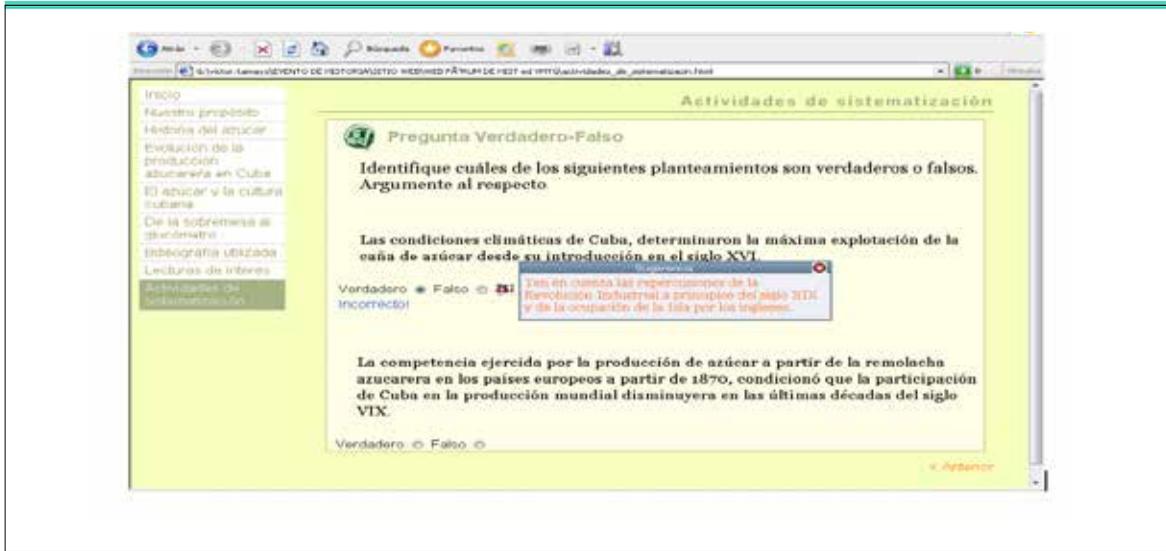


Figure 6. Example of interface corresponding to the monographic material “Impact of Sugar Production in Cuba: From the Table to the Glucometer,” visualized from the university intranet

the high number of resources in English, given their proficiency level in this language, although they recognize the importance of improving their reading and comprehension skills in this language. The set of updated lectures and book chapters created by the faculty and available in the Web course, the possibility of exchanging comments in the *Edublog*, the monographic product created by a group of students of the GCE, the possibility of accessing the Web course and all its content off line and from home, and the experience acquired from the use of ICTs during the course were considered as interesting.

Conclusions

The “Food and Phytochemicals” elective course was designed to be part of the Food Science program in a new curriculum. Its curricular design addresses innovative content within the field of Food and Nutrition. Its design conceives the curricular integration of ICTs to the EDP. In the process of its design, the course’s faculty and the student assistant intervened in interaction with GCE.

The educational resources designed and implemented are an integrated media system based on ICTs, and include chapters in electronic format, a web course, an *Edublog*, and a monographic product on the impact of sugar consumption on heal-

th, which are integrated into an electronic educational guide.

The students who took the course reported that motivation towards this type of course was achieved, considering the interaction with the media system interesting, as well as the management and evaluation of scientific information. The evaluations of the course allow to consider as positive the levels of scientific-technical update reached by the students, about the foods, their composition in phytonutrients, and their benefits to health.

Future studies are required to evaluate, using specific techniques, the impact of the use of these designed teaching aids on the skills related to the management and critical analysis of scientific information.

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