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Artículos científicos

Diseño de un ambiente de aprendizaje blended learning como propuesta de innovación educativa en la Universidad de la Sierra Juárez

*Design of a Blended Learning Environment as a Proposal for Educational
Innovation in the Universidad de la Sierra Juárez*

*Desenho de um ambiente de blended learning como proposta de inovação
educacional na Universidad de la Sierra Juárez*

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Resumen



Evaluada como pedagógicamente exitosa donde ha sido implementada, la modalidad *blended learning* combina la enseñanza presencial con la virtual. En este trabajo se presenta una propuesta de diseño de un ambiente de aprendizaje para esta modalidad para el contexto educativo de la Universidad de la Sierra Juárez (Unsij). El desarrollo del ambiente se realizó con la metodología de investigación basada en el diseño (IBD), que permitió generar un prototipo de enfoque socioconstructivista adecuado al contexto universitario de la Unsij. En un primer momento, se realizó el diagnóstico del contexto para, entre otras cosas, analizar el mapa curricular de los programas educativos, valorar la infraestructura tecnológica con la que cuenta la universidad e identificar las actitudes y competencias digitales docentes. Como parte de los resultados, la universidad cuenta con recursos digitales/tecnológicos que sirven de apoyo a la docencia, pero no con una plataforma digital de gestión del aprendizaje (LMS). Asimismo, existe una actitud favorable de los profesores para usar las tecnologías de la información y la comunicación (TIC) en su práctica docente y un nivel de competencia intermedio en el conocimiento y uso en diversas actividades, pero un nivel bajo en el uso de estas herramientas para el diseño de actividades didácticas. Por último, el modelo educativo de la institución es de tipo presencial a tiempo completo, con planes de estudio que se agrupan en dos periodos semestrales y uno de verano; en los periodos semestrales se cursan cinco materias a las que los estudiantes deben dedicar horas de estudio con docente (presencial en aula) y otras independientes. La información obtenida ayudó al diseño de un ambiente de aprendizaje para la modalidad *blended learning*, que si bien continúa a prueba y se mantiene en proceso de evaluación y seguimiento, hasta este momento ha ayudado a mejorar la práctica docente en un ambiente mediado con TIC.

Palabras clave: ambiente de aprendizaje, educación superior, enseñanza mixta, innovación educativa, tecnología educativa.

Abstract

Evaluated as pedagogically successful where it has been implemented, the blended learning modality combines face-to-face with virtual teaching. This work presents a proposal for the design of a learning environment for this modality for the educational context of the Universidad de la Sierra Juárez (UNSIJ, by its acronym in Spanish). The development of the environment was carried out with a design-based research (DBR), which allowed to generate a prototype of a socio-constructivist approach appropriate to the UNSIJ context. At first, the context diagnosis was carried out in order, among other things, to analyze the curricular map of educational programs, assess the technological infrastructure that the university has, and identify teaching attitudes and digital skills. As part of the results, the university has digital / technological resources that support teaching, but not a digital learning management platform (LMS). Likewise, there is a favorable attitude of teachers to use information and communication technologies (ICT) in their teaching practice and an intermediate level of competence in knowledge and use in various activities, but a low level in the use of these tools for the design of didactic activities. The information obtained helped to design a learning environment for the blended learning modality, which although it continues to be tested and remains in the evaluation and monitoring process, up to now it has helped to improve practice teaching in an ICT-mediated environment.

Keywords: learning environment, higher education, blended learning, educational innovation, educational technology.

Resumo

Avaliada como pedagogicamente bem-sucedida onde foi implementada, a modalidade de ensino híbrido combina o ensino presencial com o ensino virtual. Este trabalho apresenta uma proposta para o desenho de um ambiente de aprendizagem para esta modalidade para o contexto educacional da Universidade da Serra Juárez (Unsj). O desenvolvimento do ambiente foi realizado com a metodologia de pesquisa baseada no design (IBD), o que permitiu gerar um protótipo de uma abordagem sócio-constructivista adequada ao contexto universitário Unsj. Num primeiro momento, foi realizado o diagnóstico de contexto com o objetivo, entre outras coisas, de analisar o mapa curricular dos programas educativos, avaliar a infraestrutura tecnológica de que dispõe a universidade e identificar atitudes docentes e competências digitais. Como parte dos resultados, a universidade possui

recursos digitais / tecnológicos de apoio ao ensino, mas não uma plataforma digital de gestão da aprendizagem (LMS). Da mesma forma, há uma atitude favorável dos professores ao uso das tecnologias de informação e comunicação (TIC) em sua prática docente e um nível intermediário de competência no conhecimento e uso em diversas atividades, mas um baixo nível no uso destas ferramentas para a concepção de atividades didáticas. Por fim, o modelo de ensino da instituição é presencial em tempo integral, com planos de estudos que se agrupam em dois períodos semestrais e um no verão; Nos períodos semestrais, são cursadas cinco disciplinas às quais os alunos devem dedicar horas de estudo com o professor (presencial em sala de aula) e outras disciplinas independentes. As informações obtidas ajudaram a conceber um ambiente de aprendizagem para a modalidade de blended learning, que, embora continue a ser testado e permaneça em processo de avaliação e acompanhamento, até agora tem contribuído para melhorar a prática docente em ambiente mediado pelas TIC.

Palavras-chave: ambiente de aprendizagem, ensino superior, ensino misto, inovação educacional, tecnologia educacional.

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Introduction

One of the challenges faced by educational institutions at all levels is the need to initiate innovation processes to change or strengthen teaching methodologies and adapt to the challenges generated by changes brought about by social phenomena such as globalization and technological developments. , especially those related to information and communication technologies (ICT), even more particularly those related to the Internet. This need for innovation also finds support in the conclusions of forums organized by national and international organizations in which several nations participate, including Mexico (National Association of Universities and Educational Institutions [Anuies], 2000; Cher and Libing, 2016; Delors, 1996; Seara, 2010;).

Additionally, higher education institutions must serve students who arrive at the university with various deficiencies, such as a level of knowledge well below those necessary to perform at this educational level, reading comprehension and writing problems, lack of motivation and failed learning strategies that prevent them from

developing successfully in their professional training and after it (Organization for Economic Cooperation and Development [OECD], 2016).

These problems are faced in the classroom by the teacher, who, in most cases, does not have enough teacher training to be able to address them. This lack, however, can be seen as an area of opportunity and a fertile field to innovate and provide alternatives that include tools that can guide students immersed in this globalized, technical context and with the characteristics inherited from previous educational levels. These tools have to be framed in the context where the teaching-learning process is carried out, that is, they must take into account the particular characteristics of teachers and students, the educational model and the technological infrastructure (Delors, 1996).

A part of these teaching tools are the technical resources with which the teaching-learning process is supported and where ICTs play an extremely important role, since they allow the digital processing, transmission and storage of huge amounts of information for different purposes, as long as you have electronic devices and the Internet. The Internet, as is well known, is one of the most disruptive technological developments in recent times. In 1989, she promoted the appearance of web 1.0, which has evolved over the years and with technological advances; now people talk about web 2.0, web 3.0 and even web 4.0. From the web 2.0 the possibility of interacting between users and contents arose, and it allowed those not only to be consumers, but also creators of the information that was published; New communication channels also emerged: online social networks, collaborative sites such as wikis, academic and scientific collaboration networks, for example, the National Education and Research Network (RNEI), electronic commerce and, of course, education online (e-learning), which took up some of the foundations of distance education (Choudhury, 2014; Evans, 2011; Rodríguez y Espinoza, 2017).

For the technological support of e-learning, developments based on the advancement of the web emerged, such as learning management systems (LMS) and massive open online courses (MOOCs). These developments, together with pedagogical principles and instructional design methodologies, have been adopted in face-to-face education systems; In this way, new forms have emerged that combine both forms of training. One of these is precisely blended learning, which combines online and face-to-face teaching to take advantage of each of them.

By providing the possibility of innovating educational practice by including ICT in face-to-face teaching, blended learning is a modality that has proven to be pedagogically

successful (Siemens, Gašević & Shane, 2015). To take advantage of its advantages, it is necessary that this combination starts from careful planning that takes into account various factors (pedagogical, technological and contextual) that lead to a true process of educational innovation aimed at transforming or strengthening the teaching-learning process. In this sense, the teacher is one of the main actors, since with their practice they can be able to train more committed and active students in their learning process and change the conception of their role as a teacher: from being a transmitter of knowledge to guide students on the path of their training (Necuzzi, 2013; Salinas, 2004).

In this work it is argued that one of the ways to achieve this transformation is the implementation of pedagogical strategies framed in a learning environment for a blended learning modality; define activities for the students to appropriate the knowledge and the teacher guide them in this process, and give the student the opportunity to build or reconstruct their knowledge related to the subjects being addressed.

The first section describes the theoretical framework of the project. From a constructivist approach, blended learning is approached. The second part addresses the design-based research methodology (IBD) that was followed for the development of the proposal. This process was divided into the following stages: situation analysis, solution development, implementation and validation, and the production of documentation and design principles. Subsequently, the results of the analysis of the university context are presented. And finally, in the conclusions and discussions, a contrast is made with other works and theoretical principles of the blended learning modality.

Theoretical framework

From the pedagogical point of view, blended learning must allow a critical transformation of the teaching-learning process. This through a wide combination of instructional modalities that produce a displacement of teacher-centered teaching towards a scheme supported by constructivist theory, where the student assumes an active role in the learning process, through interaction in face-to-face sessions. supported by virtual instructional spaces. In the virtual space, the student has the possibility of reviewing concepts to reconstruct their knowledge schemes and socialize their learning; In the face-to-face sessions, you can discuss and put into practice these new knowledge construction schemes so that learning becomes meaningful and not only mechanical or memorization (Aiello and Willen, 2004; Ausubel 2000).



From the constructivist theory, and specifically from the socio-constructivist approach, it is argued that human learning takes place when the individual interacts with his environment, through social and cultural relationships, that is, the social construction of knowledge, where communication and Language have a significant influence, and they can be supported by cultural tools such as computers and social context (Chadwick, 2001; Salgado, 2014; Wang, 2008). This social context, which has been transformed with the digital communication tools that are available on the Internet (for example, social networks and virtual forums, where the student and teacher have the possibility to express their ideas in a more reasoned environment. the public time), has achieved with this configuration a mixed environment of pedagogical interaction. In fact, Florez (1997) points out that one of the ways that allow students to take an active and critical role in their training is the possibility of expressing themselves openly and freely, and even that it is they who can plan their teaching by selecting the resources that are easier for you.

On the other hand, socio-constructivism also serves as support for the planning of the teaching-learning process carried out by the teacher. There, in the planning, pedagogical actions are integrated that help the student to master the most important specific contents, through interaction with their context to rebuild, modify and diversify their structures, which are natural knowledge schemes. This process is accomplished with the support of a mentor with a higher level of experience to help you overcome the well-known zone of proximal development (Coll, 1989, cited in Chadwick, 2001). In a mixed environment, that mentor can be the teacher, a classmate or someone outside the physical space where the course takes place. Even in a digitized environment, that expert may be a computer system with the capacity to answer specific questions, based on information that has previously been uploaded to it. If it is observed, in this context the teacher is no longer the possessor of knowledge, rather he is the one who plans the process for learning to take place.

Based on these approaches, the following expression suggests the idea of constructivism that supports the proposal that is presented in this work:

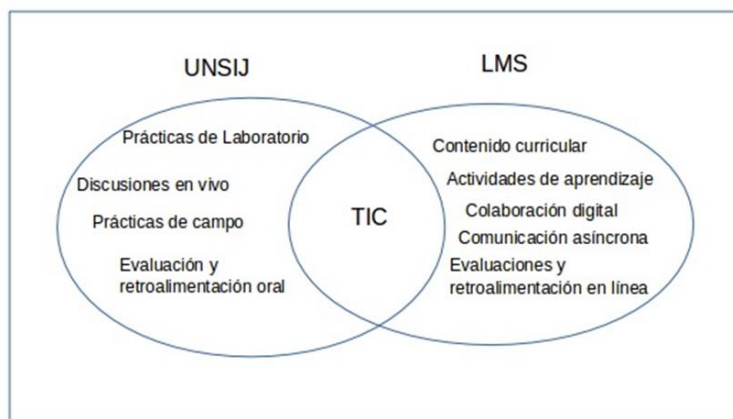
$$\text{Socioconstructivismo} = \text{Estructuras cognitivas (experiencias previas)} + \text{Aprendizaje significativo} + \text{Contexto sociocultural}$$

In this sense, constructivist sociocognitive and significant learning theories can serve as support for the design of student-centered academic tasks. On the one hand, cognitive constructivism is the basis for the design of activities that address the individual learning needs and intentions of students. And from social constructivism, the design of activities that favor collaborative learning in which students can learn significantly and correctly from each other is suggested, so that the social design of a mixed training environment must comply with safety characteristics , availability, usability and having a set of virtual and face-to-face communication strategies that motivate communication between students (Wang, 2008). On the other hand, this constructivist environment should allow the teacher to guide the training process of the students.

These constructivist approaches can be put into practice in a blended learning modality, which, as already mentioned, has shown effectiveness in improving pedagogical practices, since it has allowed the introduction of active learning strategies, peer-to-peer, centered on the student. and in collaborative work, at the same time that it has provided the possibility of reaching high levels of training through critical discourse and reflective thinking with the use of synchronous communication in face-to-face classes and asynchronous communication through virtual communication channels , which, for their part, thanks to the technological advances of the Web, LMS platforms and cloud services, provide the opportunity to create research communities (Garrison and Kanuka, 2004; Graham, 2006; Güzer and Caner, 201).

In addition to the above, the blended learning modality can take different forms in its implementation. The form will depend, among other factors, on the purposes pursued to carry out its implementation, as well as the technological resources available from the institution, students and professors and the types of content that will be mixed. These aspects will help determine the type of learning activities that can be implemented in the blended learning environment, which will define whether the activities will be in face-to-face, online or combined format. These types of tasks can be communication, collaboration, multimedia presentations or independent study; together they allow a configuration like the one shown in figure 1.

Figura 1. Ambiente *blended learning*



Fuente: Elaboración propia con base en Graham (2006)

The combination of technological resources and techno-pedagogical tools give rise to what Garrison and Vaughan (2008) consider a careful integration of face-to-face learning experiences with online or e-learning experiences to seek the redefinition of teacher-centered teaching towards an approach that positions more teaching work as a guide to student learning. In this scheme, face-to-face teaching sessions are those that take place in the physical space of the institution to take advantage of face-to-face interaction; for example, provide immediate feedback through discussion sessions, clarify doubts, carry out laboratory practices with physical equipment, field trips, visits to companies, professional stays, among many others.

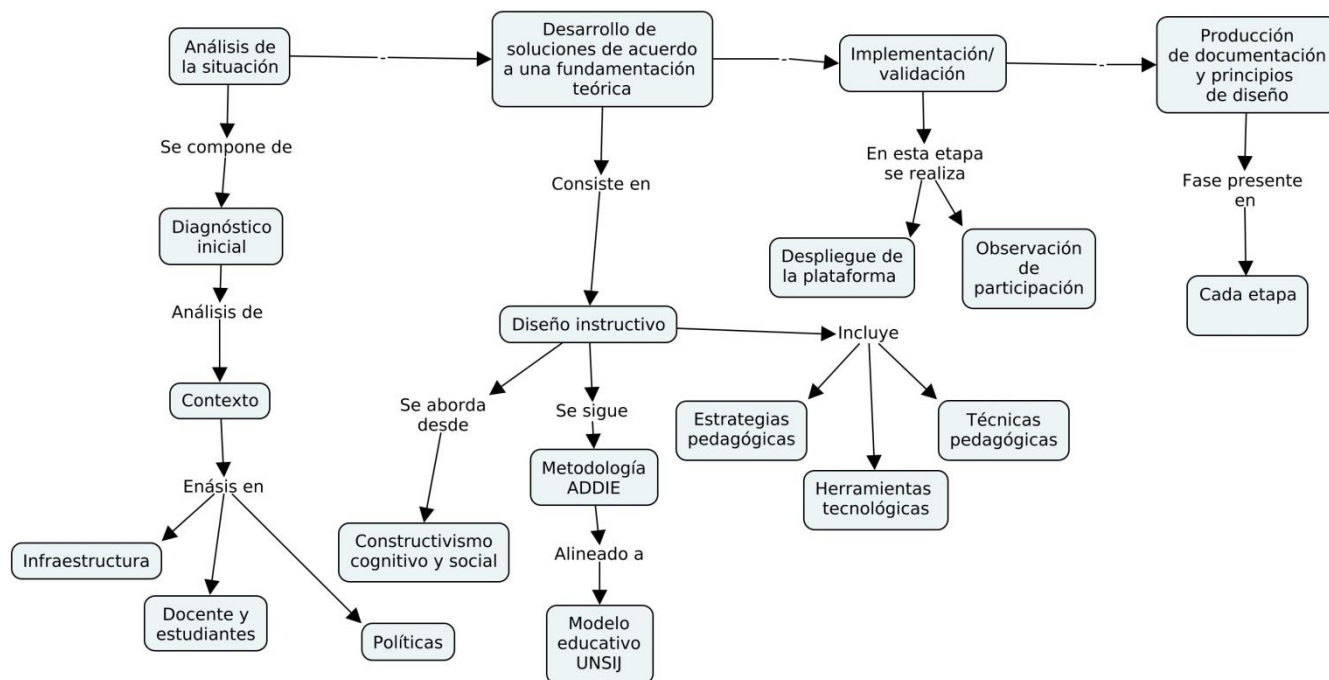
All these activities in an ICT-mediated environment are centralized to give order and follow-up through an LMS, where the pedagogical content is displayed. This content includes materials, resources, tools and activities that can be consulted in a ubiquitous way by students inside and outside the classroom. The LMS also allow creating dynamic learning environments with rich social interaction, and making use of its different standardized tools that provide the possibility of promoting communication and collaborative learning through communication channels: discussion forums and messaging section synchronous and asynchronous. With regard to the follow-up of the course, the teachers can carry out the deployment of their subjects attached to the desired institutional educational model, as well as monitor the progress of the students with the different evaluation tools and grading books. All these techno-pedagogical components are understood here as part of an e-learning system that, combined with face-to-face teaching, leads to a blended learning environment.

Methodology

For the development of the proposal, the IBD methodology was followed, which allows to improve the implemented design and the generation of guidelines for the execution of educational designs in situations with similar conditions, rather than the replication of the implemented implementations. All design research has as one of its purposes the production of theoretical contributions, either to specify, extend, validate or modify existing theory or generate new theory (de Benito and Salinas, 2016).

The design presented here is divided into a set of phases that can be seen in figure 2. As can be seen, the proposals of Benito and Salinas (2016) are retaken, who establish the stages set out below: definition of the problem , design, development, implementation and evaluation; as well as that of Reeves (2000), which divides the research process into a set of interactions that starts from the analysis of the situation / definition of the problem and continues with the development of solutions according to a theoretical foundation, implementation, validation , documentation production and design principles.

Figura 2. Fases de la investigación



Fuente: Elaboración propia con base en Reeves (2000)

The purpose of the diagnosis phase was to evaluate the relevance of the implementation of the blended learning environment, therefore, in one of the activities, information was collected on the availability of the ICT infrastructure. For this, a

documentary search was carried out from the inventories available in the Department of Material Resources of the selected university, namely, the University of the Sierra Juárez (Unsij), Oaxaca, Mexico. The head of the institution's Computer Network Department, responsible for administering and managing the ICT infrastructure, was also interviewed, as well as the head of the Computer Science degree program, who is in charge of the institutional computer rooms.

Another of the activities of the diagnostic phase consisted of collecting information on teaching digital competences through the questionnaire by Tourón, Martín, Navarro, Prada and Íñigo (2018), which takes up the analysis categories of the Institute's teaching digital competences model National Educational Technologies and Teacher Training [Intef] (2017), in addition to teaching attitudes towards ICT through the questionnaire proposed by Tejedor, García and Prada (2009). Both instruments were applied to a total of eight teachers. Likewise, information was collected on the level of access to ICT of the students of the Bachelor's degree in Computer Science; A total of 35 people, between 18 and 23 years of age, with whom the blended learning environment test was started, through the questionnaire suggested by Intel Corporation (2011).

Another of the actions consisted of reviewing the educational model of Unsij, focusing attention on the curricular structure of the study plans of the different degrees taught there.

In the solution development phase, the instructional design was carried out for the blended learning environment appropriate to the educational model and specifically to the Unsij's curricular structure, following the methodology of analysis, design, development, implementation and evaluation (Addie) and under the theoretical precepts of socio-constructivism. The foregoing in order to propose a learning environment model of this type that allows the teacher to use it in the design of their instruction, and thus modify or improve their practice to move from a teacher-centered teaching model to an environment where the student assumes an active role in their learning process. This model was launched in the implementation and validation phase, making use of an LMS Moodle platform, which was deployed within the university infrastructure and made it possible to collect information on how teachers adopted the model by monitoring teaching activities in the university. LMS platform.

Results

Diagnosis

From the results analyzed in the diagnosis phase, it is found that the current conditions of the Unsij context are adequate to be able to adopt the blended learning modality, since from the legal point of view, in article two of the Teaching Staff Regulations of the aforementioned institution, it is established as one of the substantive functions of the academic staff of the university to impart education under the principle of academic freedom. In this regard, following Seara (2010): "Academic freedom is only valid within the framework of current study plans and so that the subject program is adequately covered" (p. 44). On the other hand, the Unsij study plans are structured based on subjects grouped into study areas; Five subjects are taken in an academic semester, divided into three partial periods of five weeks and a regular period of two weeks. A subject can have from six, eight or ten credits. One credit is the estimate of academic work time for the student, and is equivalent to 16 hours of study, which are divided into hours with a teacher (HED) and hours of independent study (HEI). Of the total hours per semester for each subject, the curriculum considers 80 HED and the rest in HEI. This time distribution is summarized in Table 1.

Tabla 1. Distribución de tiempos de acuerdo al número de créditos por cada materia

Número de créditos de la materia	Número de parciales	Semanas para el desarrollo	Total de horas de trabajo		
			HED	HEI	Total
10	3	17	80	80	160
8	3	17	80	48	128
6	3	17	80	16	96

Fuente: Elaboración propia

Regarding the attitude of teachers towards ICT, the results show a positive attitude towards the use of these technological tools for the development of their teaching practice. They consider that these are very important for teaching at the present time and they consider that the teacher plays a fundamental role so that such technological tools are successfully integrated into the educational process. Likewise, they observe that their

teaching practices will improve considerably if they integrate them into their classes and, therefore, they value it convenient to include them. The teachers believe that, although this technological development does not favorably strengthen some basic skills of the students, it does contribute positively to the students' learning, in addition to improving the communication process between the participants of a course, all which contributes to a richer pedagogical interaction, as mentioned by Garrison and Kanuka (2004). Finally, all the teaching staff shows an outstanding interest regarding the institutional ICT equipment: they consider it a very relevant resource.

In relation to teaching digital competencies, they show an intermediate level, within three domain seats, in the information literacy category, which indicates that they are able to develop their digital competence autonomously, which is in line with what exposed by Tourón et al. (2018). In the same way, they have an intermediate level in the knowledge and use of communication and collaboration tools, but they need to apply them with greater intensity in the teaching of their subjects. They make a moderate use of tools for the creation of digital pedagogical content, and do not promote this activity in the students' tasks. Something similar happens with regard to the safe use of ICT. On average, they also show an intermediate level of competence in solving basic problems of devices and software, however, the data collected shows that it is necessary to encourage a higher level of collaboration and mutual help in the digital environment in the teaching staff. Table 2 shows a summary of the different areas analyzed with respect to teaching digital skills.

Tabla 2. Resumen de categorías y nivel de uso y conocimiento en las competencias digitales docente de las y los profesores de la Unsj

Áreas	Nivel de conocimiento y uso
Información y alfabetización informacional	Intermedio
Comunicación y colaboración	Intermedio
Creación de contenidos digitales	Básico
Seguridad	Básico
Resolución de problemas	Intermedio

Fuente: Elaboración propia

Regarding the university's ICT equipment, Table 3 presents a summary of the facilities and equipment related to this area owned by the university, and Table 4 shows the network services offered in the university infrastructure, which also provides broadband Internet connectivity services (100 Mb / s) through institutional computers or personal computers to all professors and students.

Tabla 3. Componentes de *hardware* e instalaciones

Equipo e instalaciones	Cantidad	Disponibilidad
Salas de cómputo	5	24 x 7
Laboratorios de TIC	3	24 x 7
Departamentos de soporte técnico	1	Lunes a sábado de 8:00 a 19:00 h
Salas de autoacceso	3	24 x 7
Computadoras (escritorio y portátiles)	300	24 x 7
Servidores	3	24 x 7

Fuente: Elaboración propia

Tabla 4. Servicios de red

Servicios de red	Cantidad	Disponibilidad
Web	3	24 x 7
Correo electrónico	1	24 x 7
LMS	0	-
DHCP	1	24 x 7
DNS	1	24 x 7
Wifi	1	24 x 7

Fuente: Elaboración propia

Unsj is also associated with the Cisco Systems Netacad academy, which connects institutions of different educational levels around 180 countries, and through which educational content is distributed online through a platform called Netspace supported by the LMS Canvas. (Cisco Systems, 2019).

Instructional design

The proposal is approached from a socio-constructivist perspective for the integration of ICT in the teaching-learning process (Wang, 2008). To approach the subjects, a time distribution scheme is proposed based on the number of credits described in the subject's study plan and taking into account that in the semester a student must take five subjects simultaneously, corresponding to the disciplinary areas of their training, and one of foreign language learning. This scheme is shown in table 1.

The periods for the development of the subjects are defined in the school calendar, which, as already mentioned, divides the academic semester into three partial periods and one ordinary. For each one of the partials, a time of 50 hours of academic work is established divided into five weeks for each subject taken, of which 25 hours must be HED and the rest HEI. For the ordinary period, five HEDs are considered and the rest of HEI divided into two weeks. This distribution is summarized in Table 5.

Tabla 5. Distribución de tiempos por parcial y por ordinario

Créditos de la materia	Parciales	Ordinario	Semanas por parcial	Semanas por ordinario	Total de horas de trabajo				
					HED parcial	HEI parcial	HED Ordinario	HEI Ordinario	Total de horas
10	3	1	5	2	25	25	5	5	160
8	3	1	5	2	25	14	5	6	128
6	3	1	5	2	25	4	5	4	96

Fuente: Elaboración propia

Regarding the evaluation in each subject, a weight of 50% is allocated for the three partial periods and the other 50% for the ordinary one, and it is up to the teacher to establish the weighting for each partial period according to the proposed learning activities .

The study plans suggest in each one of the partials to apply a written exam and complement it with the other academic activities.

In the planning for each course a didactic sequence is proposed divided into three moments: beginning, development and closing; With the exception of the ordinary, period in which only a closing moment is considered (because it is short). Each of these is assigned a specific time of HED and HEI, depending on the type of activity, as shown in table 6. With regard to the allocation of hours for each activity, it is specified that these will depend on the subject and the characteristics of the students, so there is flexibility on the part of the teacher in the distribution of time. Likewise, this scheme can also be distributed by semi-annual periods; However, due to the same restrictions of the study plans for the evaluation of students, the distribution shown here is the most appropriate for this university context.

Tabla 6. Propuesta de distribución de sesiones, momentos, semanas y horas de trabajo por asignatura

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17
Momentos y periodos																
Parcial 1					Parcial 2					Parcial 3					Ordinario	
I	D	D	D	C	I	D	D	D	C	I	D	D	D	C	C	
HED					HED					HED					HED	
5	15			5	5	15			5	5	15			5	5	
HEI 10 Créditos					HEI 10 Créditos					HEI 10 Créditos					HEI 10 C	
5	15			5	5	15			5	5	15			5	15	
HEI 8 Créditos					HEI 8 Créditos					HEI 8 Créditos					HEI 8 C	
2	10			2	2	10			2	2	10			2	6	
HEI 6 Créditos					HEI 6 Créditos					HEI 6 C					HEI 6 C	
1	2			1	1	2			1	1	2			1	4	

Fuente: Elaboración propia

The working time per learning moment will be used to estimate the working hours for the teacher and the student, according to the time and type of activity. Table 7 presents an outline considering the credits of the subject for a partial period.

Tabla 7. Lista de actividades por momento, periodo y créditos de la asignatura

Actividades	Momento	Parcial de 10 créditos		Parcial de 8 créditos		Parcial de 6 créditos	
		HED	HEI	HED	HEI	HED	HEI
Recuperación de saberes previos	Inicio	2	3	2	2	2	1
Actividad de motivación	Inicio	3	2	3	2	3	1
Construcción de conocimientos	Desarrollo	7	8	7	3	7	1
Aplicación de conocimientos (desarrollo de habilidades)	Desarrollo	8	7	8	3	8	1
Evaluación	Cierre	5	5	5	4	5	1

Fuente: Elaboración propia

Table 8 shows a proposal of activities for a 10-credit subject based on the distribution of times and suggested activities in Table 8.

Tabla 8. Diseño de actividades para un periodo parcial

Momento	Actividad	Objetivos de aprendizaje	Modalidad
Inicio 10 horas	Actividad de inicio		
	Introducción al parcial y retroalimentación de conocimientos	Recuperación de saberes previos	Presencial / Virtual
	Revisión del contenido didáctico	Construir conocimientos	Virtual / Plataforma LMS
	Aplica conocimientos	Reconoce la aplicación del conocimiento	Presencial / Virtual
	Autoevaluación	Reconocer y valorar aprendizajes	Presencial / Virtual
Desarrollo 30 horas	Sesión de desarrollo (15 HED + 15 HEI)		
	Revisión de contenido	Construye Socializa conocimientos Colabora en el diseño de contenido	Virtual
	Aplicación de conocimientos	Desarrollo de habilidades Reconstrucción de conocimiento	Presencial / Virtual
	Socializar conocimientos y saberes	Desarrollo de habilidades comunicativas	Presencial / Virtual
	Evaluaciones formativas y sumativas	Reconocer y valorar aprendizajes	Presencial / Virtual
Cierre (10 horas)	Sesión de cierre (5 HED + 5 HEI)		
	Actividad integradora	Integración de conocimientos	Presencial / Virtual
Evaluación	Evaluación sumativa en forma de examen	Valoración de aprendizajes	Virtual

Fuente: Elaboración propia

All activity is made up of a set of strategies that are developed in a combined environment between presence and virtuality. As can be seen in figure 3, an interaction is sought between the course participants.

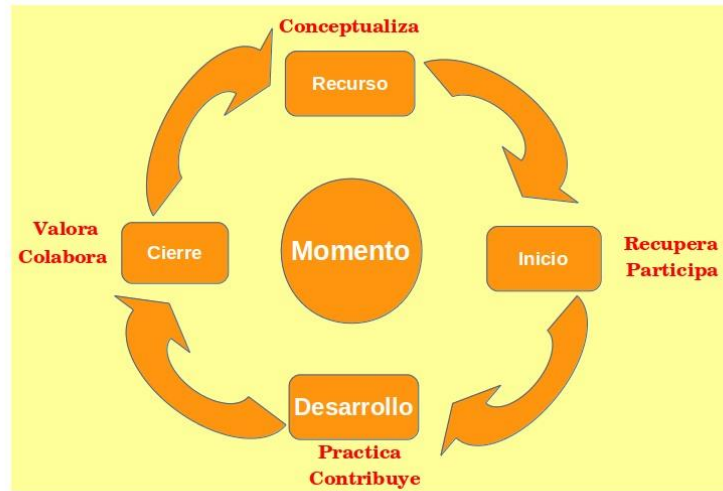
Figura 3. Formato de actividad *blended*



Fuente: Elaboración propia

The structure of each period is made up of at least three moments and a set of resources. In each of them, a set of strategies are proposed that allow the teacher to guide the learning process of the students and where the teacher's role is modified according to the moment. Resources can be self-made or selected from external sources. In any case, they must comply with the characteristics of scientific rigor, as expressed by Florez (1997), and appropriate to the learning objectives established by the study plan of each subject. Figure 4 shows a sketch of a partial period.

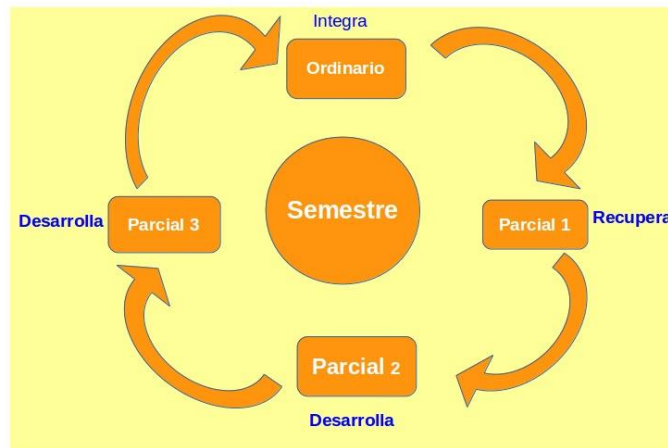
Figura 4. Estructura de un periodo



Fuente: Elaboración propia

The semester structure of a subject is shown in Figure 5 and is made up of three partial periods and one ordinary period, regardless of the credits it contains, and this includes the resources and activities distributed in a blended learning mode, according to the nature of the subject and the learning objectives.

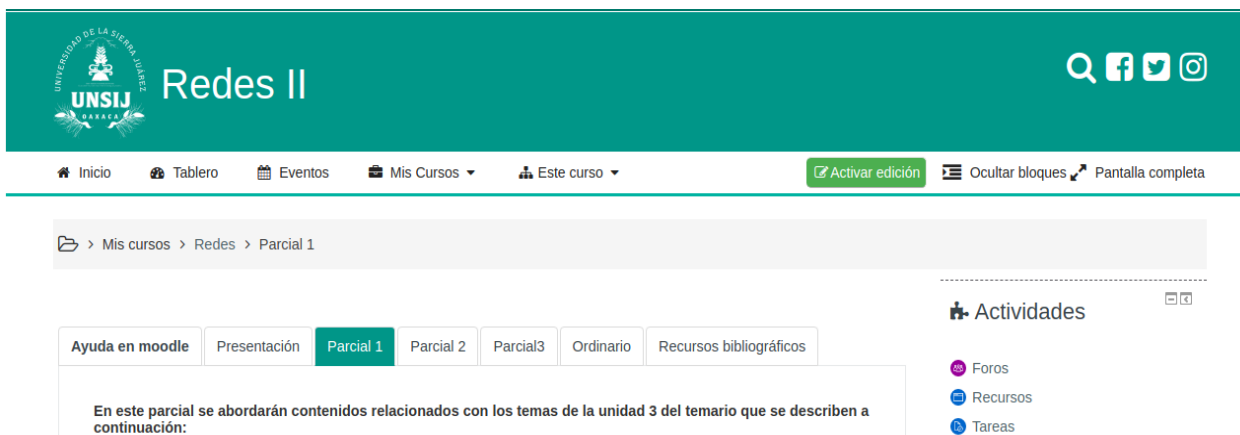
Figura 5. Estructura de un semestre escolar



Fuente: Elaboración propia

This model was implemented in the second semester of the 2018-2019 school year in two subjects of the Unsij's Computer Science degree. For the virtual deployment, Moodle was used, which is a web system that is distributed under the terms of the GNU General Public License. This LMS offered the possibility of organizing a course on topics, and in each one of them activities and resources could be integrated to guide students on the path of their learning (see figure 6). In this case, each topic consisted of an academic period. The course was divided into three partial periods and one ordinary. In each one, learning activities, discussion forums, evaluation activities, informational resources, as well as the monitoring of students were deployed, adhering to the times established in the study programs of each subject and to the principles of socio-constructivism. (Aristizábal y Dieste, 2011; Moodle, 2019)

Figura 6. Portada de un curso desplegado en Moodle



Fuente: Elaboración propia

These e-learning resources served as support in the face-to-face class sessions, which, according to university regulations, must be taught at an established time in a classroom or physical laboratory. This combination made it possible to configure the blended learning environment: the advantages of face-to-face teaching with e-learning resources. Thus, together, they provided the possibility of designing and carrying out the planning of the teaching-learning process with the support of an LMS that provided various web tools, such as hyperlinks to relate the learning activities with the instructions, the contents and the assessment instruments, which allowed the student to follow an order in the development of the topics in well-defined periods, in addition to having the possibility of self-directing their learning according to their abilities and times, in a safe environment,



since, Through the LMS system, access to the virtual classroom is also controlled to authorize and provide personalized monitoring.

Discussion

Contextually, the Unsij has a favorable environment for the adoption of the blended learning modality. From the administrative and curricular normative plane, there are the bases that allow the use of ICT as a tool to support the teaching-learning process. However, at the institutional level, there were no defined policies or guidelines that promote the reflexive adoption of these tools, so it is necessary to make the institutional directive aware of their development, since they are necessary to achieve strengthening of teaching work, such as and as expressed by Unesco (2014).

Regarding the teaching attitudes towards the use of ICT in their teaching practice and the opinion regarding institutional technological equipment, another favorable aspect is observed in the use of ICT in the mixed modality. It should be clarified that this favorable attitude towards the use of digital devices and resources is technocentric and logocentric (Escontrela, 2008). In other words, technological means are considered an end in themselves, maintaining the transmissive practices of face-to-face education with the support of digital artifacts. Consequently, it is important to continue motivating the change of attitude towards a reflective use of ICT, which strengthens the pedagogical interaction and from where other forms of learning are supported.

The foregoing is verified in the information obtained in relation to teaching digital skills, where it is observed that teachers have an intermediate domain in the area of information literacy and in the management of communication and collaboration tools, and a basic level in the development of pedagogical content and collaborative work, with which it is inferred that they are not applying strategies that favor a transition towards new teaching approaches that allow taking advantage of the facilities and opportunities of digital tools and the vision of the teacher as a center of knowledge continues to prevail, a fact that can be seen in a comment made by the teachers about their activity in the classroom and that was recurrent in the meetings where the project was presented: "I explain the contents of the topic".

These observed aspects, although they favor the use of ICT in the teaching-learning process, also represent a challenge: to achieve awareness of both the directive and the teaching staff about the need to move towards a teaching approach that allows setting up an

environment learning enriched with technology to strengthen teaching practice, since, as can be seen, the interviewed students have access to and use digital technology in their training process, so it is necessary to support the student in the development of new ways of learning, and be critical and reflective about information sources. Approaches that can be seen in the purposes of the different frameworks of teaching digital competencies: Unesco (2019), Redecker (2017) and Intef (2017).

Given the circumstances found in the diagnosis phase, the model presented here is appropriate and complies with what is required by Vaughan (2013) and Wang (2008) in order to reflectively adopt the use of ICT in educational teaching environments. in person. However, again, the main challenge remains the change of vision of those in charge of putting the principles described here into practice. Undoubtedly, it is necessary to promote the development of activities that favor social presence, cognitive presence and teaching presence.

Conclusions

In this work, the conjugation of various methodological bases of educational design and planning is achieved, guided by the IBD as a scientific research methodology. In the same way, the design is proposed with a constructivist theoretical basis to obtain and test a model of a blended learning environment suitable for a predetermined educational space. The starting point was the analysis of the context then proceeded to the design of the environment, the testing of this and the generation of the documentation that is shared here to contribute to the knowledge of this modality that mixes the advantages of classroom teaching with supported in virtual environments. The results achieved here are still being evaluated to continue improving the design, however, in principle, some of the scope with which this edition closes could be highlighted.

Regarding the ICT infrastructure, it is observed that, despite the fact that the institution has it and that there is an adequate level of access to these resources, it is still necessary to promote the appropriation of these tools in the members of this university community, something that is viewed as viable with the blended learning modality, since it not only focuses on the technological part, but also allows the use of ICT resources to promote changes in the teaching modality, to ensure that students assume a role active in their learning process, which is one of the main approaches of the constructivist current.

With regard to teaching digital skills, as in the previous case, it is observed that there is still the possibility of improving the knowledge and use of some areas. It is possible to affirm that the implementation of this environment motivates the adoption and development of this area, since it is necessary to make use of the options offered by the LMS platform for the deployment of digital pedagogical content, also coupled with the boost that can be given to collaborative work to form a virtual teaching-learning community. Finally, it is confirmed that the only use of ICT in teaching does not mean educational innovation; This inclusion needs to be accompanied by a set of actions that allows a transformation of teaching methods, with a focus on active students in their learning process, where the teacher's attitude of change plays a relevant role.

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