Instructional Design in Blended Learning: Theoretical Foundations and Guidelines for Practice

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Abstract This chapter highlights the need to base blended-learning (b-learning) teaching activities on models and pedagogical approaches validated by educational research. The most relevant theoretical models in publications about the instructional design of b-learning in the last few years are selected and described. Firstly, the theoretical foundations for b-learning are identified, with theoretical-explanatory models (CoI, TPACK) and theoretical-applied models (UDL and ARCS). Then, several generic models of instructional design are classified and described (ADDIE, ASSURE, MRK and DDD-E), based on standards (iNACOL and Quality Matters) and specific for b-learning environments (BLC and IDM-BHE). To end with some didactic orientations for the development of pedagogical designs in b-learning.

Keywords Blended learning · Instructional design · Educational technology · Instructional innovation · Educational strategies

1 Introduction

In the last few years, research has shown significant interest in the design and development of pedagogical models of blended learning (from now on; b-learning) that respond to the needs of teachers and students in this hybrid teaching-learning environment. There is a need for the creation of a theoretical corpus or a pedagogy of b-learning that can offer a solid foundation on which to support the effective design of b-learning environments, as well as the need for explanatory theories on b-learning based on empirical evidence [1]. Although most of the studies on b-learning identify its underlying theoretical framework (constructivism, for example), how this theory is materialized in real design principles is often not clearly defined. Research on these hybrid learning environments (face-to-face/online) should be more explicit

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about their design, as well as introducing more rigor in the pedagogical justification of the teaching practices in b-learning. This mixed modality has proven to be a potentially effective learning approach if the pedagogical design is made with care, before its implementation [2–5].

A review of the research on b-learning developed through doctoral theses revealed that one-third of the studies deal with issues related to instructional design. More specifically, a greater emphasis on «models, strategies and good practices» themes were seen, which is reasonable, bearing in mind that it is a new environment that requires greater knowledge about applicable principles and approaches [6]. Even so, the conclusion is a need for more research in this field, as educational institutions have problems to conceptualize and implement an effective combination of face-to-face and online teaching [7]. In this respect, and as a result of a systematic review of the literature, several challenges that students participating in a b-learning environment must face in the online part were identified [8]: (a) Self-regulation (procrastination, search for online help, self-regulation skills, preparation before face-to-face classes, time management skills, use of peer learning strategies); (b) digital literacy and skills (use of interfaces, resistance to technology, distraction caused by excessive technological complexity, weaknesses in the use of digital technologies); (c) isolation (feeling of loneliness, problems with synchronous communication); (d) access to technology (lack of technological devices and infrastructures, obsolete technologies, inadequate internet access) and (e) Technological complexity. These variables should be taken into account in any pedagogical design for b-learning.

Successful b-learning experiences underline the importance of institutional support for redesigning and planning a course [9, 10]. Therefore, the impact of b-learning on educational institutions is the result of a series of factors that are directly related to the instructional design [11]: (a) An educational approach based on the identity and shared vision of the organization. (b) A differentiating educational factor, which adds value to the learning process and offers a competitive advantage compared to other institutions. (c) Prior experimentation, in the form of pilot projects that generate knowledge and institutional commitment. (d) A learning ecosystem that transforms educational practices within a technological environment with subject, pedagogical and technical support. (e) A cultural change in the conception of teacher-student roles for transforming the educational model. And (f) a didactic design that takes into account modes of interaction, type of educational resources and assessment of the learning and the process.

The pedagogical design of blended-learning environments faces four challenges [12]: (a) *incorporating flexibility*, i.e., giving the students some level of control on the time and space of learning, curricular organization (sequence of contents and pace of learning) and even the possibility of choosing the type of modality for specific learning (online or face-to-face).; (b) *Stimulating interaction*, i.e., developing a dual channel (face-to-face and virtual) for communication between teachers and students, which makes the most of both channels of educational relationship. (c) *Facilitating students' learning processes*: in a b-learning context where self-regulated learning is a factor of academic success, it is necessary for teachers to use strategies to plan the learning (difficulty of the task, expectations and goals, prior knowledge, time

required), control of the process (continual feedback), adaptation based on results obtained (change in the development of the process) and self-evaluation of the learning. And, finally, (d) *affective learning climate*, i.e., creating an environment that offers the student security, positive attitudes and the feeling of belonging to the group to favor intrinsic motivation, creativity and subjective wellbeing.

These four challenges offer a pedagogical framework that is useful for: (1) Designing new b-learning environments, (2) communicating and sharing b-learning designs and (3) evaluation of existing b-learning practices.

A series of relevant studies led by Graham have filled a great void in research on b-learning, by providing a pedagogical framework and a series of guidelines for its development in educational institutions. On the one hand, they have defined three stages in the adoption of b-learning by educational institutions [13]: (a) *awareness-exploration*: of the need to improve learning results and address the challenges of growth, the institutions consider the possibility of introducing b-learning in their academic offer; (b) *redefinition-restructuring*: once b-learning is adopted, institutions modify the organizational structures and establish programs for training teachers and teaching incentives; (c) *implementation-development*: institutions have assimilated that educational innovation and b-learning is a routine process which is worked on for continual improvement through an emphasis on the evaluation and decision making based on data (*learning analytics*). On the other hand, they analyzed the research themes on b-learning and discovered that the issue producing the most scientific production was «instructional design» (models, strategies and good practices, process design, implementation and structure of the learning environment). And they identified four habitual usage patterns of these models of instructional design [14]: (1) *A framework to guide the design*: the specific components that teachers should take into consideration in the design of b-learning are identified. (2) *An evaluation tool*: principles and standards that should be included in the b-learning evaluation process are identified. (3) *A design process model*: guidelines on how to carry out b-learning planning. (4) *An instruction model*: description of a course or teaching practice with all the elements that have been put into action (dissemination of contents, communicative interaction and organization model). With regard to factors that favor the adoption of b-learning, the following were identified [15]: availability of sufficient infrastructure, technical and pedagogical support, evaluation data on b-learning and a consensus on the vision of the management team and teachers regarding the adoption of b-learning as an educational modality. Finally, as a result of the analysis of different case studies of educational institutions that use b-learning, a series of recommendations were made [16]: (a) to develop an infrastructure that is sufficient and robust, to facilitate the adoption of b-learning, as well as to provide pedagogical and technical training for the transformation of face-to-face teaching practices into b-learning educational experience integrating the best elements of both contexts and (b) to implement a continuous and scalable system of pedagogical advice and technical support, both for teachers and students, who do not have sufficient competences to effectively teach and learn in a b-learning environment.

2 Theoretical Foundations for Designing b-learning

Good instructional design requires a solid theoretical base on which to justify its didactic proposals. The current status of pedagogical knowledge offers us different theoretical frameworks that are backed by educational research and the acknowledgment of b-learning experts. The following describes two global models that offer a theoretical-explanatory structure of the b-learning phenomenon (Community of Inquiry) and the integration of technology in teaching practices (TPACK). A theoretical-applied model on the principles of a universal instructional design for learning (UDL) that takes into consideration individual differences in b-learning. Finally, a theoretical model of the affective-motivational component (ARCS) that introduces us to the emotional component of learning in b-learning contexts.

2.1 Community of Inquiry (CoI)

The relationship between b-learning and constructivist collaborative approaches has an essential reference in the «Community of Inquiry» (CoI) [17] theory, backed by abundant scientific literature, which has made it the most commonly used theoretical model by b-learning researchers [18–21]. CoI is a process of design and development of significant and deep learning experiences, through three interdependent elements [22]: social presence, cognitive presence and teaching presence.

Social presence is the capacity of participants to identify with the group, communicate openly in a context based on trust and progressively develop personal and affective relationships, projecting their personality. Social presence in an educational context creates a climate that supports and encourages the formulation of questions, skepticism and the contribution of ideas explaining phenomena and processes. There are three indicators of social presence: (a) Affective communication, that is materialized in the use of iconic elements for communicating feelings, an inclusive and empathic language, as well as personal openness to express moods. (b) Open communication, based on a climate of trust, which permits questioning but protects self-esteem. And (c) Cohesive responses, a cohesive group is able to build knowledge collaboratively. In any case, the goals of a community of inquiry are focused on the achievement of results and, consequently, sharing feelings is not an end in itself.

Cognitive presence represents the degree to which students are able to build meanings through reflection and dialogue in a community of inquiry. It is associated to the development of critical thought (reasoning, evaluation and judgment) and it is carried out in «practical inquiry», which is articulated in four phases: (a) Triggering event, which is a dilemma or problem that the students should study from their prior knowledge and experiences. (b) Exploration, that tries to understand the nature of the problem and look for relevant information and possible explanations. (c) Integration, which is a phase of construction and creation of knowledge, where asynchronous

communication tools (v.gr. forums) can play a highly relevant role in b-learning. And (d) Resolution, that offers a plausible answer to the dilemma or problem proposed. Nevertheless, the resolution is rarely achieved entirely and, as a result of this phase, new questions and issues arise, which give rise to other search and research cycles, encouraging continuous learning.

Finally, teaching presence offers a structure and orientation in the design and development of the learning community. Coordinating, stimulating and classifying the social and cognitive processes to achieve learning results that are personally significant and valuable from an educational point of view. It is a process that does not exclusively involve the teacher (it is not the presence of the «teacher», but rather the «teaching»), as in a community of inquiry, the roles and responsibilities are shared between all members. It is composed of three elements: (a) Design and organization, in a b-learning context, curricular planning requires that before starting, the objectives and competences expected to be developed, have been clearly established, sequencing knowledge, teaching methodology, time organization, selection of the technological resources to be used and the atmosphere of the group. (b) Facilitating discourse, as a result of reflection and debate, areas of agreement and disagreement should be identified; looking for consensus and understanding accepted by the group, continuously reinforcing the contributions of group members, taking care of the learning climate and evaluating the efficacy of the process. (c) Direct instruction, to resolve specific content issues or overcome possible mistaken understanding of concepts or procedures. Here, the teacher should show a pedagogical capacity to anticipate the difficulties of learning, organize learning activities for deepening knowledge, moderate debates, offer additional sources of information and offer structured content when necessary to advance in learning.

2.2 Technological, Pedagogical and Content Knowledge (TPACK)

In any b-learning educational practice, three basic components of knowledge can be identified: Content Knowledge (CK), Pedagogical Knowledge (PK) and Technological Knowledge (TK). Additionally, the relation established between the three. These three knowledge bases (CK, PK and TK) form the core of the TPACK [23, 24] model. Content Knowledge (CK) is the knowledge about the area of knowledge, subject or discipline being taught and learnt. The differences between different degrees of competence about knowledge of the curricular content reflect different strategies to integrate digital technologies in the teaching activity and define the degree of a good b-learning educational practice. Pedagogical Knowledge (PK) is in-depth knowledge about the processes and practices or methods of teaching and learning. It includes knowledge about didactic methodologies, student profiles or techniques to evaluate the learning. Technological Knowledge (TK) is more than just technical knowledge about the digital devices and it requires the teacher to have a global comprehension of

ICT, to be able to apply them effectively in the teaching activity; to recognize when technology can contribute or limit the achievement of a goal and be able to adapt to changes in these technologies continuously. The interactions between these three types of knowledge give rise to three typologies: PCK, which is concerned with the identification of the most common conceptual errors; the importance of establishing connections between different ideas of the curricular contents; the pupil's prior knowledge; alternative teaching strategies or flexibility to explore alternative ways to understand the same idea or problem. TCK is a comprehension of the form in which technology and the curricular contents mutually influence and limit each other. The teacher needs to understand which specific technologies are the best to use in their learning content and how the curricular content determines the technology, and vice versa. TPK is an understanding of how teaching and learning change when certain technologies are used. Teachers need to develop skills that overcome the technology itself and «reconfigure» it creatively for their pedagogical purposes.

This theoretical approach is coherent with other research and theoretical proposals that have tried to expand Shulman's idea about PCK (Pedagogical Content Knowledge) to the domain of educational technology [25]. TPACK is a model based on extensive empirical research that has been applied in b-learning environments [26, 27]. It is a model that is focused on pragmatic knowledge, closely linked to the teaching practice and, therefore, with the intention of immediately applying its principles to b-learning models. In this regard, it enables us to define and assess good educational practice with digital technologies. It facilitates the exploration and explanation of educational phenomena linked to the use of digital technologies, find new questions in the development of educational research on technology and design training programs for teachers.

2.3 Universal Design for Learning (UDL)

The presence of Universal Design for Learning (UDL) in the education sector and, especially, in teaching with technologies, has gained significant interest, being defined in the Higher Education Opportunity Act of the United States as «a scientifically valid framework to guide educational practice that: (a) Provides flexibility in the forms information is presented to students, the forms of responding or proving knowledge and skills, and in the forms in which students can be involved in this process, and (b) Reduces barriers in teaching, offers appropriate adaptation, support, challenges and maintains high expectations of achievement for all students, including disabled students and students with a limited command of the English language» [28]. The «National Center on Universal Design for Learning» (https://www.udlcenter.org) developed the principles, criteria and indicators of the UDL. The approaches of the UDL are based on progress in the architectural design, the evolution of technologies for education and results of research on the brain. Taking concepts from neuroscience and cognitive psychology as a reference, influenced by

authors such as Bruner, Piaget and, very especially, the Zone of Proximal Development and the framework, proposed by Vigotsky. Studies carried out on the UDL show three fundamental principles in the application of this model to teaching, to which a series of principles are associated, for their application in blended learning educational practice [29]: (1) Provide multiple means of representation. This principle implies three guidelines: Offer options to drum up interest, provide options to maintain effort and persistence and provide options for self-regulation. (2) Provide multiple means for action and expression. They suggest three guidelines: provide options of perception, provide options for language and symbols and provide options for comprehension. (3) Provide multiple forms of involvement. The three guidelines offered are: To provide options for physical action, to provide options for expressive skills and fluency and to provide options for executive functions.

The b-learning models that follow this model with the use of digital didactic materials are characterized by the following attributes [30]: (a) Versatility: The capacity to easily and quickly adapt to different functions, enabling the same content in digital format to be presented and viewed in different formats. (b) Capacity for transformation: double possibility that the same content moves from one format to another, without the conversion meaning a change in the content. (c) Marking: Label the contents so that they can be reorganized or reconstructed in versions based on selections determined by the user. (d) Connectivity: These media enable one content to be related to another, incorporating hyperlinks that enable text navigation and connect to other elements in the text. These characteristics contribute to design and development of b-learning models under the Universal Design for learning, the application of which, specifically, enables barriers to be eliminated, diversity acknowledged, and education made accessible for all.

2.4 The ARCS Model

The ARCS [31] model is appropriate to design b-learning models that encourage motivation to learn. ARCS is based on an elaborate synthesis of the research on motivation to learn, and it is structured around four categories: Attention, Relevance, Confidence and Satisfaction [32]. The starting point corresponds to the category of «Attention», which contains motivational variables related to stimulating and maintaining the curiosity and interest of learners. The next step consists in ensuring that the student believes that the learning experience is personally relevant, i.e., that it is linked to significant personal goals. Then it is necessary for adequate success expectations to be generated, that the student holds no fear or mistaken perceptions about their capacity to achieve the learning or overestimates their competences regarding the demands of the knowledge. Finally, to maintain their desire to learn, they must experience personal satisfaction in the process developed or the results obtained, either through extrinsic or intrinsic reinforcement. The following table contains the orientations to apply the ARCS model (Table 1).

Table 1 Categories of Keller's ARCS model [31]

Category	Definition
Attention	Arouse the interest of the learner. Stimulate curiosity for learning
Relevance	Find the learners' needs or personal objectives, to obtain a positive attitude
Confidence	Help learners to believe and perceive that they will be successful and will control their achievements
Satisfaction	Reinforce achievements with rewards (internal and external)

Source Prepared by the author

Each of the categories includes a series of subcategories that are useful to estimate the motivational profile of students and create strategies to overcome motivational problems. For the «Attention» category, the ARCS model includes three subcategories:

- *Perceptual arousal.* Responding to the question: What to do to capture interest? It is a type of curiosity that refers to the reflex reactions to stimuli. In a blended learning model, we need to think up strategies to capture the initial attention of our students. This is the first step in the attention process, but it is transitory, as human beings quickly adapt to a situation.
- *Inquiry arousal.* Is related to the question: How can I stimulate an attitude of inquiry? This is a deeper level of curiosity, which can be activated, showing the problem situation that can only be resolved by an active search for knowledge.
- *Variability*. Is a requirement for maintaining attention. Stimulus profits from a frequent change of stimuli, small variations in the presentation of information or different forms of encouraging thought, reflection or action (Fig. 1).

The «Relevance» category is an influential factor in the design of b-learning models because, if the user perceives that the material can satisfy personal needs or desires, they will be more motivated to use it. The subcategories of this dimension are the following.

- *Goal orientation*. People feel motivated to learn when they perceive that the learning will help to achieve an objective that they value personally or professionally. In b-learning models, we must look for strategies that help to improve understanding of the relations between concepts and practical applications of this knowledge in a specific personal, social or work activity.
- *Motive matching*. Some people prefer to learn by the definition of goals that enable them to determine the means to achieve them individually, others are more comfortable in competitive environments that stimulate their effort in comparison with others and, some people are more motivated if there is collaboration and cooperation in a work team.

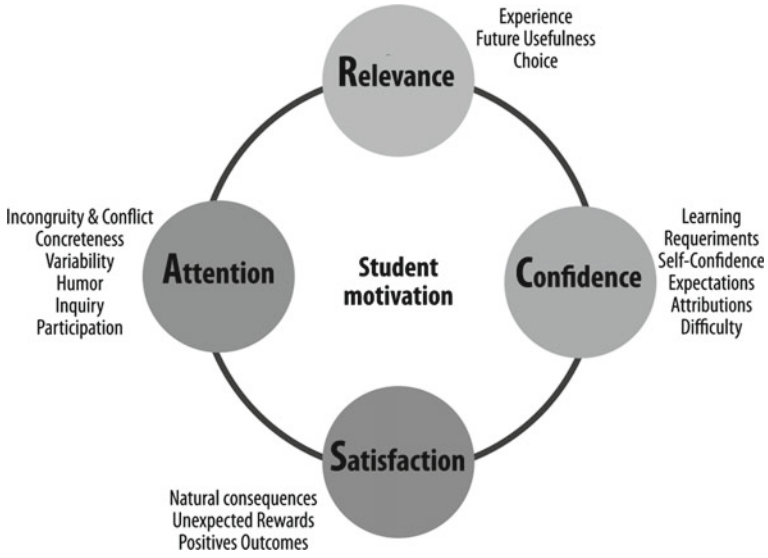

Fig. 1 Keller's ARCS Model [31]. *Source* Prepared by the author

- *Familiarity*. Although novelty is a motivational factor, we are indeed more interested in contents that have some connection with prior knowledge. It is essential to provide success experiences in the learning process, to generate sufficient confidence and reduce feelings of failure or frustration.

The subcategories identified in this «Confidence» category of the ARCS model, are the following:

- *Learning requirements*. A b-learning mode student should know what is expected from their learning. In this respect, it is very useful to incorporate evaluation headings with the criteria and levels of attainment of the goals.
- *Success opportunities*. Once the achievement expectations have been generated, the student must obtain results perceived as successes in their learning process. Challenges should be graded, so that they are adapted to the level of development of the desired competence.
- *Personal control*. The educational model should offer the perception that the learner controls the learning experience, so that their autonomy is increased, as well as the sensation of self-control of the process.

The final step in the motivational process is to create satisfaction, so that the interest in learning continues and the pedagogical qualities of the educational material are evaluated positively. ARCS defines the following subcategories:

- *Natural consequences*. The most motivational experience takes place when a person can apply their new knowledge at the end of the learning process and experience, by themselves, that they have competences they did not have before.

The b-learning model should provide opportunities for the user to obtain their own evidence of progress (e.g. simulations, case studies, etc.)

Positive consequences. A final reward materializes, before oneself and others, a recognition of the effort carried out. The use of gamification mechanisms may be highly appropriate for b-learning environments.

3 Models and Pedagogical Approaches in Blended-Learning

Once the theoretical foundations for designing b-learning have been described, the different models applied for instructional design that are used for the combined teaching-learning (face-to-face/online) contexts are analyzed. Firstly, generic models that are used for the pedagogical design of b-learning (ADDIE, ASSURE, MRK and DDD-E) are identified. Secondly, models that use educational standards for online education and which, consequently, have an evaluative character (iNACOL and Quality Matters). Finally, specific design models for b-learning environments (BLC and IDM-BHE) are described.

3.1 Instructional Design Models

In the scientific production of the last few years, the instructional design models in b-learning are diverse. However, generic models such as ASSURE and ADDIE are still predominant, due to their versatility in different educational contexts, even used combined. Although other models are also identified in the b-learning context, which are described below, and which can contribute to building, in a combined manner, a theoretical-practical corpus for the design and implementation of b-learning in educational contexts.

3.1.1 The ADDIE Model

ADDIE is a sequential and iterative model, characterized by encompassing the principal phases of instructional design [33]. Being a general model, it constitutes the basis of the current instructional design model due to its versatility to adapt to any educational context, including the training program in b-learning. The acronym ADDIE refers to the processes that comprise the development of instructional design [34]:

- Analyze. The analysis phase involves the initial collection of information and evaluation of the needs of the environment, definition of the problem or objectives,

identifying their causes or modes to achieve them. From these analyses, the inputs for the next phase are derived.
- Design. This process should determine how to achieve the educational goals obtained during the analysis phase, and present the pedagogical foundations of the training activity.
- Develop: Generate the units, modules and didactic materials.
- Implement: Put into practice the instructional program, efficiently and effectively.
- Evaluate: Carry out a formative evaluation (throughout the whole process) and summative (at the end of the training process).

The ADDIE model is backed by its usefulness and good results in comparison to traditional instruction models in the latest research carried out. The research of Durak et al. [35] obtains interesting recommendations in the application of the model in a b-learning course at the university level. Firstly, following the design model has enabled them to resolve problems found during the process and the duration of the training, showing finally that the planning was adequate. The fact of selecting synchronous and face-to-face, and asynchronous and virtual materials and resources, makes thinking about how to use them in both environments fundamental to enhance their efficacy. They also include, as an added element to educational support, the social support that should be offered to students during the training process. In this respect, they recommend taking into account all the dimensions of the interaction and communication, so it will be effective from the beginning. On preparing a training activity, all the elements found in the analysis phase should be taken into account, paying particular attention to needs analysis, analysis of pupils, technical analysis and structural analysis. Following the phases, they recommend developing a pilot action that helps to determine and overcome any shortfalls before the real application. Finally, they provide the need to generate a strong bond between the evaluation of each phase and the redesign, noting how iterative and recursive the model is, with the possibility of developing it in a non-linear sequential manner, the design process offering a clear advantage. The importance of the creation of interaction processes, participation and feedback with the students to generate meaningful learning in training activities designed under the ADDIE model in b-learning environments has also become evident [36].

3.1.2 The ASSURE Model

The ASSURE model [37] (Analyze Learners; State Standards & Objectives; Select Strategies, Technology, Media & Materials; Utilize Technology, Media & Materials), is based on the instructional principles of Robert Gagne and it is widely used in designs that integrate technologies in teaching-learning environments, with a clear vision towards student learning. The creators of the model aimed to help teachers integrate technologies, resources and materials in the classroom simply and effectively. The model is focused on the selection of tools and resources to achieve the learning goals form a perspective of student communication and participation. For

this purpose, when considering designs in b-learning, it is necessary to define which technological resources work better for the context in which the training will take place and how these resources will be used to improve the learning experience. To answer these questions, the ASSURE model suggests six procedures that must be followed in the design of blended-learning training models [38].

- Analyze learners. To know the characteristics of the students and their learning styles.
- State standards and objectives. The model requires establishing objectives clearly oriented towards learning results.
- Select strategies, technology, media, and materials. Selection of methods, resources and materials considered most appropriate for achieving the learning objectives.
- Utilize technology, media, and material. Use of technologies, media and resources with evidence of an effective implementation plan.
- Require learner participation. Student participation, planning strategies that make students active during the entire process
- Evaluate and revise. Referring to the evaluation of student learning and academic performance.

Through these six steps, the model shows how to select, use and evaluate technological and didactic resources, as a fundamental part of the systematic design of the teaching-learning process. Having a highly practical approach, ASSURE is one of the most commonly used models in the sphere of instructional design in b-learning. The model has a positive influence on student learning, especially if the communication, support and encouragement of student participation are designed effectively [39].

3.1.3 The Kemp Model (MRK)

Kemp's model or MRK [40] is a framework of instructional design very widely used in the design of training in online and b-learning modality. It is based on a systematic process that takes into consideration the key factors of a teaching-learning environment, that can be extended to designs for training in digital environments in three broad iterative phases: Analysis, development of strategies and evaluation, represented cyclically. The process of systematic design suggested by Kemp's model consists of nine steps that are interrelated, interdependent and non-linear: (1) Identify instructional design problems and specify relevant goals. (2) Examine the characteristics of the pupils. (3) Identify the contents of the subject and analyze the components of the task that are related to the learning objectives. (4) Establish and set learning objectives that the students should know. (5) Sequence the content within each unit or theme to respond to logical learning. (6) Design didactic strategies so that each pupil will achieve the learning objectives. (7) Plan the didactic delivery. (8) Develop instruments of evaluation to verify that the objectives are achieved. (9) Select the resources to support the learning activities.

This non-linear and interrelated nature of its components (systems approach) makes the design process cyclical and flexible. This vision places emphasis on the management of the design process and evaluation of the process itself, involving all factors that could interfere in a learning environment [41]. An adaptation of the model to b-learning was carried out, based on self-regulated learning and the design of learning activities that activate the cognitive processes of the students, to achieve effective involvement in their own learning. The best teaching model is considered to be that which offers a variety of activities and procedures to stimulate individual cognition, using a self-regulated learning strategy [42].

3.1.4 The DDD-Model E

The DDD-E model (Decide, Design, Develop and Evaluate), is a constructivist approach based on the design of multimedia training [43]. This model offers a general framework on which to base the development of b-learning projects, from a systematic and flexible perspective. It consists of three principal phases that comprise the three "D"s, surrounding the Evaluation phase. According to the authors of the model, it can improve creativity and attitudes of the students and promote a more in-depth experience and a greater understanding of the content.

- Decide. The decision phase focuses on establishing objectives and the main program, contents, learning standards and student roles.
- Design. The design phase is the fundamental phase of this model, considering that it is necessary to invest 50% of the total time used in the process to this. It is the phase where what is going to be developed and how it is going to be done is specified.
- Develop. The development phase is the moment when the resources needed for the project are produced.
- Evaluate. The evaluation phase focuses on formative and summative evaluation implemented during and at the end of the project. This includes assessment of student progress through the task throughout the process, completed student work and the levels of student participation, the success of the project as a whole and the development of plans for change, if necessary.

3.2 Standard-Based Models

3.2.1 iNACOL

The International Association for K-12 Online Learning (iNACOL) developed the «National Standards for Quality Online Courses» [44]. The purpose of this standard is to provide a set of quality guidelines to generate b-learning models, from Primary to

Secondary education. It is focused on teachers, the education administration and Governments that formulate educational policies. The standards encompass the content of the training activities, the instructional design, the technology, student evaluation and course management. It is focused on emerging models of blended learning, generating processes with multiple stages that establish, in time, high-quality b-learning models.

iNACOL's assessment rubric consists of 52 specific criteria that define the expected action and recommendations, so, evaluators look for the evidence of the presence of the mentioned criteria in the training activity. The evidence has five levels on a scale of 0–4 (absence, unsatisfactory, moderately satisfactory, satisfactory and very satisfactory). It is divided into five dimensions or sections, which in turn encompass several sub-dimensions:

- Content. The description indicates that the course provides online learners with multiple ways of engaging with learning experiences that promote their mastery of content and are aligned with state or national content standards. It includes subdimensions: Academic Content Standards and Assessments, Course Overview and Introduction, Legal and Acceptable Use Policies and Instructor Resources.
- Instructional Design. This dimension describes that the course uses learning activities that engage students in active learning; provide students with multiple learning paths to master; the content is based on student needs; and provides ample opportunities for interaction and communication student to student, student to instructor and instructor to student. The sub-dimensions are Instructional and Audience Analysis, Course, Unit and Lesson Design, Instructional Strategies and Activities, Communication and Interaction and Resources and Materials.
- Student Assessment. Describing that the course uses multiple strategies and activities to assess student readiness for and progress in course content and provides students with feedback on their progress. It includes the sub dimensions: Evaluation Strategies, Feedback and Assessment Resources and Materials.
- Technology. Describing that the course takes full advantage of a variety of technology tools, has a user-friendly interface and meets accessibility standards for interoperability and access for learners with special needs. The sub-dimensions of this section are: Course Architecture, User Interface, Technology Requirements and Interoperability, Accessibility and Data Security.
- Course Evaluation and Support. This dimension describes that the course is evaluated regularly for effectiveness, using a variety of assessment strategies, and the findings are used as a basis for improvement. The course is kept up to date, both in content and in the application of new research on course design and technologies. Online instructors and their students are prepared to teach and learn in an online environment and are provided support during the course. Its sub-dimensions are: Assessing Course Effectiveness, Course Updates, Certification and Instructor and Student Support.

3.2.2 Quality Matters

Quality Matters is one of the best-known quality standards models, and it is specifically focused on Higher Education. QM consists of an assessment rubric of 43 standards, grouped in 8 categories to assess the quality of training already designed and create peer review processes, in university studies. They are currently the most commonly used standards in USA universities for designing wholly online courses or in b-learning. The eight categories are [45]:

- Course Overview and Introduction (9 specific standards). A specific criterion to address the introduction of each course.
- Learning Objectives (Competencies) (5 specific standards). The criteria of this dimension are focused on the formulation of objectives of each training activity, including items that are related to specific objectives to organize student learning according to their prior knowledge.
- Assessment and Measurement (5 specific standards). Includes the standards related to assessment, from providing constructive feedback to helping in the design of evaluations appropriate to encourage student learning.
- Instructional Materials (5 specific standards). The items constitute principles for designing learning experiences that promote comprehension, regarding the materials that will be used, and the learning objectives established previously.
- Learning Activities and Learner Interaction (4 specific standards). The standards referring to interaction are related to the promotion of the learner's feeling of belonging to a community of learners that are supported and motivated through learning and communication activities.
- Course Technology (4 specific standards). Criteria referring to the technology used for communication with the student.
- Learner Support (4 specific standards). These items are related to the constant availability of a help system when the students need it.
- Accessibility and Usability (6 specific standards). Are the standards related to accessibility and usability, so disabled students can use the training with equal opportunities to their classmates.

It includes notes that contain examples to find evidence that can help evaluators (3 in each process) and recommendations for improvement if the standard is not fulfilled. In a complementary manner, it strives to guarantee internal consistency in the training actions through the alignment of their most important components: learning objectives, activities, materials, tools and evaluation. The training should reach 85 over 99 points to obtain an assessment of the course with the QM seal.

This assessment rubric has enabled higher education institutions improve the confidence of teachers in the development of b-learning training, especially in the incorporation of the online part [46]. Other studies show good results in the application of QM to the design of quality training by teachers, in contrast to other design models [47, 48].

3.3 Specific Design Models for b-learning

3.3.1 The Blended Learning Curriculum (BLC) Design

The BLC design model [49] is based on Merrill's instructional principles [50], constructivism (deep learning, community of practice) and an updated vision of constructivism. It aims to provide a conceptual framework and a practical guide for designing b-learning environments. The model has three main components: (1) pre-analysis; (2) design of activities and resources; (3) evaluation of the learning.

The pre-analysis phase determines the appropriateness of the b-learning by analyzing three factors: (1) The characteristics of the students (prior knowledge, learning preferences, etc.); (2) the analysis of the learning objects, i.e., what should be taught based on knowledge taxonomy (v.gr. Bloom); and (3) Analysis of the b-learning context, with the aim of determining the degree of competence of the students and explain, in detail, the learning activities for correct organization of the teaching process. The second phase of the model is destined to the design of activities and resources, and it includes three subcomponents: global design of the b-learning that identifies the learning activities, the strategy of dissemination of the knowledge and the support that the teacher will give to the students. The most important feature of this phase is that the attention is focused on defining which are the activities and resources best adapted to the non-face-to-face context and which to the face-to-face context. The third phase deals with the design evaluation, and it is based on the objectives, the expected learning results and the pedagogical approach of the b-learning environment. The most common strategies are e-portfolios and online knowledge tests.

Development of the teaching process in a b-learning environment according to the BLC model is organized in three modules. The function of the first module (Curriculum Lead-in) is to show the students the objectives of learning, describe the tasks that they must carry out, identify the materials for studying and establish the communication channels to be used. The second module introduces a series of teaching and learning activities. The teacher must choose a classroom activity that will involve the student, either individually or in a group, in a self-regulated activity developed online. The results of this task return to the traditional classroom to receive feedback from the teacher and the students. This process should consolidate the learning, promote progress in the knowledge and carry out transfers of what has been learnt. Alternatively, the development can begin with autonomous activities of the students on-line and be enriched with subsequent face-to-face activities until the task is completed. Finally, the third model develops the evaluation of the results of learning, by different techniques focused on formational evaluation that encourages deep learning.

To design b-learning activities, the BLC model defines four main components: (a) *Lead-in*, which aims to show the learning activity to the students, which implies describing the purpose of the task, exemplifying the activity, informing of the resources needed for its implementation and offering a clear organization about how

to carry out the whole process. (b) *Planning*, the aim of which is for students to define the task by their own knowledge and using brainstorming, definition of the problem, identification of the factors involved and establishment of the steps to follow. (c) *Acting*, the aim of which is to carry out the learning activity, according to the requested requirements, in a virtual teaching-learning environment and it implies the search for and selection of information and the creation of products in different formats (text, audio-visual, graphic). (d) *Reviewing*, which aims to transfer the knowledge built by the learning activities and sharing the results with colleagues. This component of the model implies the presentation of products, revision of the process and feedback from the teacher. The model is cyclical, with the virtual teaching-learning environment in the center of the four stages. Moreover, each of the four components is related to Merrill's instructional principles (Lead-in/Demonstration; Planning/Application; Acting/Activation; Reviewing/Integration).

3.3.2 Instructional Design Model for Blended Higher Education (IDM-BHE)

This instructional design model [51] is characterized by a pyramid structure which, in comparison with the circular-cyclical models (e.g. CoI) or linear (e.g. ADDIE), is considered more appropriate to offer a process defined in levels and specifically oriented to pedagogical design (objectives, activities, evaluation). The pyramid-shaped presentation of the model enables identification of what the temporal development of the design process should be, by reading left to right and top to bottom (See Fig. 2). Each level requires having carried out the previous, as they are interdependent. Four levels are defined with a variable number of components (Fig. 3).

Level 1. On this level, a series of basic aspects for the design are defined, so the information collected should be rigorous and relevant. For its development, documentation and data from the education organization should be used. It includes four components: (a) *Assess Needs*. Using different techniques (e.g. Delphi), training needs of different nature are detected. From these studies, the need to develop new competencies arises, to certify specific knowledge, train for the use of emerging technology or deepen certain disciplinary content. In general, the aim is to identify gaps between the training offered and current social demand. (b) *Analyze Learners.* There are different sources of information to obtain relevant data: Admission interviews, questionnaires before the course, direct observation, academic reports, observations made by other teachers or learning analytics of a Learning Management System (e.g. Moodle). For b-learning to be successful, students should be the focal point of the design. Many variables must be taken into account (prior knowledge, experience, attitudes and skills, etc.) that can affect the correct development of the teaching-learning process. (c) *State Goals*. The formulation of goals is fundamental to define the purpose and goal of the b-learning. (d) *Analyze resources*. To identify the resources needed is an essential step in order to check if they are adequate to the planned goals, to the design of the activities the evaluation, as well as the possibilities

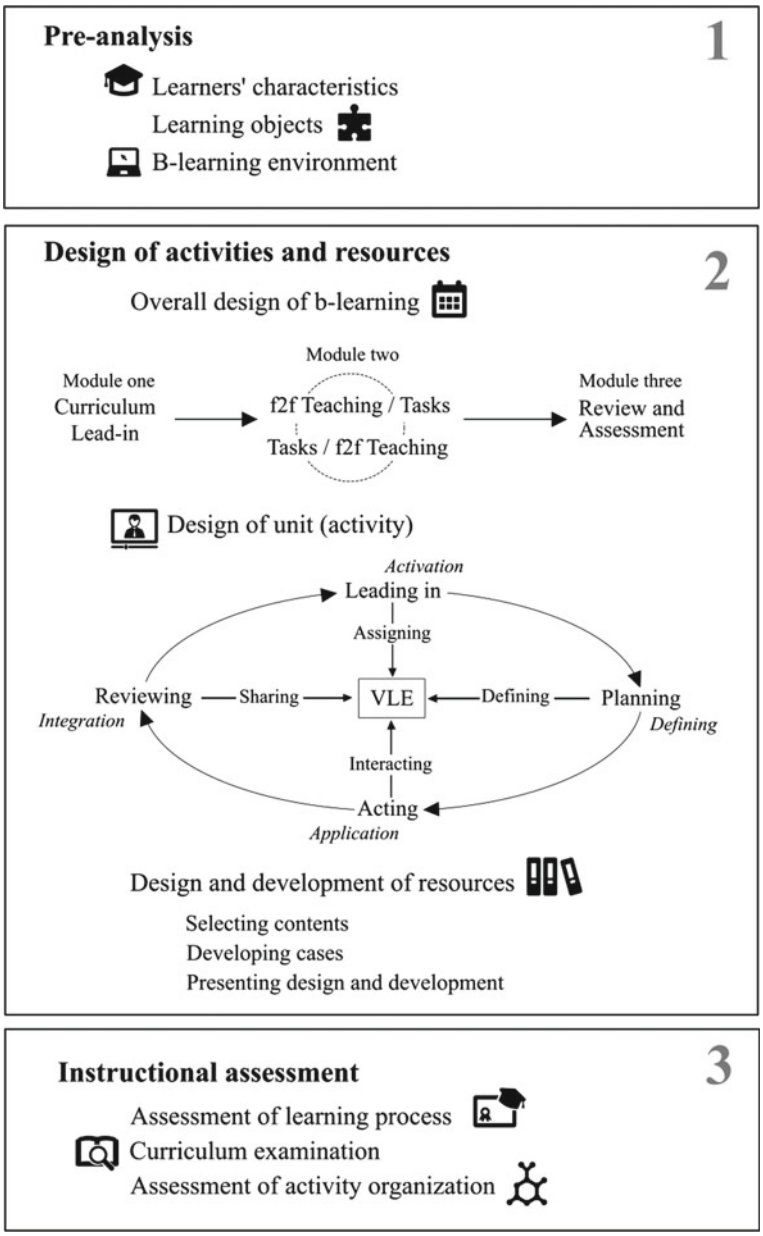

Fig. 2 Components and subcomponents of the BCL model [49]. *Source* Prepared by the author

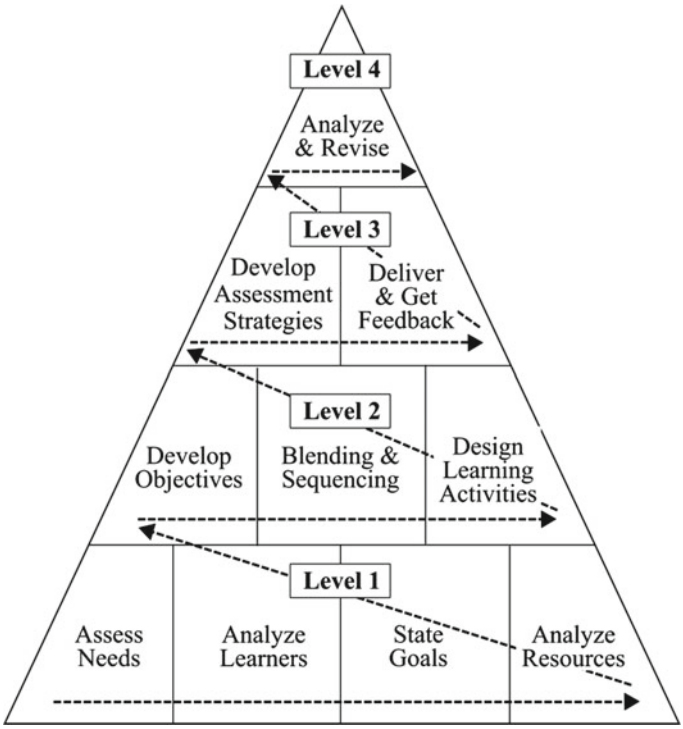

Fig. 3 Pyramid model of the IDM-BHE [51]. *Source* Prepared by the author

of development of the b-learning. It is essential to know the limitations under which the teaching activity will be developed.

Level 2. Has three components: (a) *Develop objectives.* The formulation of goals are important for different reasons: They provide a plan for designing the teaching activity, enable an efficient assessment of the quality of the teaching-learning process, offer criteria for the selection of the educational resources, contribute to determining the most appropriate didactic methodology or defining the sequencing of the contents. They communicate what should be learnt and establish expectations for teachers and students. In this respect, they are a relevant element for evaluating the results of learning. (b) *Blending and Sequencing*. The implementation of b-learning can be carried out with different strategies. The most common consists of digitizing all the exhibition activities using videos, slide presentations or texts for sharing online and carrying out practical activities in the face-to-face sessions. Another method consists in classifying the learning objectives according to their position in the Bloom's taxonomy [52]. Those situated at the lower levels (e.g., remember, understand) are developed through virtual teaching-learning environments and for those corresponding to higher levels (e.g. evaluate, create), face-to-face classes are used. In this manner, the face-to-face activities are reserved for complex problem resolution activities, case studies, guided professional practice or construction of

knowledge, among others. A third option consists in the design of learning activities that encompass different objectives, and which are developed in the online environment as preparation for the face-to-face sessions, that are dedicated to activities of deepening in the knowledge by open problem resolution or high dialectical level and argumentative debates. Regardless of the approach adopted, the information obtained in Level 1 of model about needs, resources, objectives and profiles of the students contribute to decision-making on the best methodological choice. For sequencing of the knowledge, some basic guidelines should be respected that recommend starting by initially presenting the less complicated concepts, principles or procedures. Teach in an integrated manner concepts that should be understood jointly; or begin by affirming prior knowledge before introducing new. (c) *Design learning activities*. Must be coherent with the objectives and contents defined previously. Their level of difficulty should be established according to the defined sequence, so that complexity increases as prior competencies are developed. If we go by Bloom's taxonomy, types of activities for the upper levels would be case studies, learning based on projects, learning based on problems, learning-service, learning by discovering or role-playing, among others. In the case of lower taxonomic levels, individual reading activities are designed, demonstrations, video-presentations or information collection work, among others.

Level 3. Has two components: (a) *Develop Assessment Strategies*. Its function is to select the methods and techniques to be applied to evaluate learning. Additionally, to estimate the degree of attainment of learning results, it offers information about the appropriateness of the instructional design, establishing improvement plans that affect all the components of the design and identifying the principal weaknesses concerning the intended objectives. If an evaluation strategy is not defined, the data collected through the learning activities cannot be interpreted effectively. (b) *Deliver & Get Feedback*. A b-learning environment requires rigorous control of the feedback offered to the students, both online and face-to-face, so that it is ensured that the learning difficulties are not caused by an absence of coordination between both contexts. In b-learning, it is habitual for the student's workload to be excessive in certain moments of the process and this affects their performance and the teacher's capacity to manage the demands of the pupils through forums and evaluation of activities. On the other hand, it is very relevant to control the degree of self-efficacy of the students, so that their expectations of success remain at adequate levels.

Level 4. *Analyze & Revised*. Once implemented, any design requires revision to modify components that do not work as desired. To carry out this process, it is fundamental to have ample and updated information. It is vital to consider the teacher's assessment of the strengths and weaknesses of the b-learning experience and prioritize the most critical elements. Needs and objectives change with time, and each context has its own particularities, so it will always be necessary to carry out adjustments and improvements in the instructional design.

4 Orientations for Developing Pedagogical Designs in Blended Learning

There are four basic questions that any instructional designer should ask and answer to create and develop a b-learning education experience. The first question is: «How do we globally focus on pedagogical design in b-learning to achieve good learning results?» When designing b-learning, it is adequate to start with systemic approaches, which combine several design models and theoretical approaches, emphasizing the student's activity to achieve the learning objectives. This orientation forces us to consider decisive factors such as learning strategies to maintain attention and motivation of the students, the communication processes that maintain a proactive learning process in all directions, the role and the presence of the teacher in each environment (face-to-face and virtual) and the evaluation processes of the learning results. Alonso et al. [53] developed a pedagogical design model for a b-learning environment that incorporates different learning theories, from which the central factors and related implications for its design are extracted. Later, they use the ADDIE model to organize and view the result graphically [53]. Other designs [54] also combine generic models such as «Kemp's Model» and ADDIE with a constructivist theoretical approach to generate systemic processes in b-learning. These proactive approaches that combine self-managed learning, learning online and face-to-face learning determine that these types of systemic and flexible designs produce a more efficient b-learning experience, with positive learning results.

Analyzing the materialization of the process, the second question to answer is: «how to get the students to commit to the learning activities?» The key factor is to identify relevant factors that affect the motivation and interest of our students. In this respect, it is necessary to create plausible situations for factors such as: atmosphere (security and a feeling of belonging to the group), stimulus (feedback, acknowledgment and support), autonomy (options, control and flexibility), interactivity (collaboration, cooperation and community), relevance (significance, authenticity, interest), commitment (effort, involvement and dedication) and tension (challenge, dissonance, and controversy). To facilitate the answer to this question, the «TEC-VARIETY» design principles for online education [55] are useful, as they include 100 types of activities, on the foundations of model R2D2 (read, reflect, display, and do) [56] to which 10 motivational components are added: (1) Tone/Climate: Psychological Safety, Comfort, Sense of Belonging. (2) Encouragement: Feedback, Responsiveness, Praise, Supports. (3) Curiosity: Surprise, Intrigue, Unknowns; (4) Variety: Novelty, Fun, Fantasy. (5) Autonomy: Choice, Control, Flexibility, Opportunities. (6) Relevance: Meaningful, Authentic, Interesting. (7) Interactivity: Collaborative, Team-Based, Community. (8) Engagement: Effort, Involvement, Investment. (9) Tension: Challenge, Dissonance, Controversy; and (10) Yielding Products: Goal Driven, Purposeful Vision, Ownership.

The third question is: «how to approach the transmission/construction of the knowledge?» To answer this question, we must value the relevance of the resources to be used for transmission/construction of knowledge in the students. From this

perspective, we must value the suitability of a type of educational resources for transmission/construction of knowledge in a b-learning modality and reflect on the ideal pedagogical approach to promote deep learning, i.e., comprehensive and not merely memory-based. Thus, we should analyze the importance or relevance given to the following resources and the most adequate way to use them: contents created by the teaching staff by subjects or slide presentations, external contents with copyleft licenses (Open Educational Resources), asynchronous video-classes, synchronous video-classes (videoconferences, micro-activities such as exercises or tasks about specific themes in a subject, for short-term resolution (2–3 days) or macro-activities, which are tasks about global issues of one or more subjects for medium-term creation (2–3 weeks). Justifying the reasons why we give them this valuation, we can answer this question.

Finally, the question to be answered is: «how to design and apply the evaluation of the learning to the b-learning model?» To answer this, it is necessary to evaluate the adaptation of the educational techniques for the evaluation of learning in a b-learning modality. Our analysis proposal starts from an assessment rubric in which the efficacy of each technique is assessed as an instrument of evaluation to assess the development of the learning (competencies). Starting by analyzing the difficulty to create (for the teacher), usefulness for the teacher, usefulness for the student of each of the techniques most commonly used in b-learning (Table 2).

5 Conclusions

Educational institutions face new challenges to develop digital education, and their success depends on a series of conditions that must be met [57]: (1) Increase the integration of digital education through blended learning. (2) Carry out important investments in pedagogical design, educational research and tools/ digital competencies; (3) provide support for students (24/7); (4) fully involve the teaching staff and provide adequate development and training, encouraging a culture of innovation in teaching; and (5) strengthening learning analysis for training assessment.

Some emerging technologies are beginning to take a leading position in the development of b-learning models and should be considered in future instructional designs. We are referring to virtual reality and augmented reality, games and gamification or technologies based on cybernetics and nanotechnology [58]. The progress in artificial intelligence, the evolution of learning analytics, among other emerging technologies, will bring a panorama of new epistemologies, theoretical approaches and pedagogical models in training systems. This fact shows that instructional design is a corpus of theories in movement that advances towards training models that offer learning experiences in b-learning educational contexts with more sophisticated digital technologies. B-learning requires a new vision of pedagogy, as it is modifying the nature of didactic communication, traditionally anchored in excessively long and student-passive presentation classes. B-learning is a disruptive technology that is transforming the concept of the teaching-learning process in educational contexts.

Table 2 Scale for assessing evaluation techniques in b-learning

Evaluation techniques	Efficacy as an instrument for evaluation (validity to assess competencies)					Difficulty to create (teacher)					Usefulness for the teacher					Usefulness for the student				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Rubrics																				
Portfolio																				
Application of knowledge (simulations, case studies, resolving practical cases …)																				
Creation of products (demonstration of competencies by the creation of a product)																				
Questionnaires and objective tests (multiple choice)																				
Self-evaluation exercises																				

(continued)

Table 2 (continued)

Evaluation techniques	Efficacy as an instrument for evaluation (validity to assess competencies)					Difficulty to create (teacher)					Usefulness for the teacher					Usefulness for the student				
Peer evaluation (co-evaluation)																				
Use of blogs and wikis																				

Source Prepared by the author

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