

Integrated Intermodal Model of Online Teaching-Learning: A Proposal Focusing on Edu-Communication and Online Interactions

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ABSTRACT

The advent of the pandemic in the years 2020-2021 further deepened the discussion about educational design that was guided by educational communicative practices. The objective of this work was to develop an online teaching-learning model focused on interaction and edu-communication. The study followed the Integrated Mixed Research Strategy in five stages. Firstly, the problem and objectives of the research were identified, by surveying the theoretical framework. Next, a qualitative field study was conducted with qualitative meta-synthesis and content analysis. The information collected revealed a correlation between the content of the articles and the main approaches in the theoretical foundation, pointing to a collaborative learning model in online teaching, with a focus on learning communities, modularization of objectives and content, and emphasis on interaction, being observed a lack in the methodological area of edu-communication and interrelations with interaction. To develop the Integrated Intermodal Model of online teaching-learning, concepts from convergent approaches and theories from the meta-synthesis sample were added. This resulted in a prototype of online educational design for flexible, digital environments, supported by ICTs, promoting reflection, interaction, autonomy, and dialogue. It is important to highlight that the model requires additional replication, review, testing, and validation.

Keywords: Online Education, Learning Theory, Learning Design, Interaction, Edu-communication.

INTRODUCTION

The social phenomenon of education plays an essential role in the transformation and active participation of the individual in society, being impacted by the changes of eras and their paradigms⁽¹⁾.

The face-to-face educational system, even today, is focused on a pedagogical logic founded in the Industrial Revolution, which was based on direct interaction between students and teachers, giving the teacher total control of the pedagogical process, being structured by age, workload, and learning levels. The learning theories closest to the perspectives of this model were Positivism/Objectivism and Behaviorism, which emphasized unidirectional communication and the teacher's authority in the teaching-learning process ^(2; 3).

The arrival of the digital era required the adaptation of educational processes, due to the rapid updating of information and professional practices. Distance Education (DE) has become more direct with the advancement of Information and Communication Technologies (ICTs) and social networks, incorporating technologies such as the internet, video conferencing, wikis, and repositories, giving way to online education, which is characterized by the exclusive use of networked instruments and means (online) to provide educational experiences, seeking to develop collaborative, critical, contextualized and reflective learning, with a focus on student autonomy^(4; 5; 6; 7).

Reflective Learning Theories

Going beyond the perception of unidirectional communication and emphasizing the reflective processes of learning, the cognitivist theory adopted an interactionist approach, considering the mental processes in learning and their relationship with the object studied. Likewise, constructivist theory emphasizes learning as a social process, dependent on the active attitude of individuals and interaction with the environment ^(8; 9; 10; 11).

Two approaches have been prominent in the development of online education: connectivism and online collaborative learning. Connectivism understands learning as a network of information, in which active participants contribute to the fluidity of the network and develop knowledge collectively ⁽¹²⁾ and the theory of online collaborative learning highlights the use of computer networks to improve personal and social communication, reinforcing their ubiquitous communication capacity and promoting the transfer of knowledge in a collaborative and creative virtual environment ⁽¹³⁾.

Wenger and Lave's (2008) situated learning theory ⁽¹⁴⁾ highlights legitimized peripheral participation, where subjects are inserted and actively participate in a community of practice, building knowledge contextually and collaboratively. Garrison, Anderson and Archer (2000) ⁽¹⁵⁾ were the creators of the Community of Inquiry (CoI), whose central concept involves three distinct presences - Cognitive, Social and Teaching - that interact to provide an educational experience. The cognitive presence is related to the construction of meanings, the social presence deals with the personal projection of the members and the teaching presence refers to the structuring and facilitation of the learning design, such presences are interrelated as can be seen in Figure 1. In education online, CoI faces linguistic challenges as communication is predominantly textual, limiting non-verbal expression but at the same time offering time and space for reflection and critical thinking ⁽¹⁵⁾.



Figure 1: Community of Inquiry

Source: Garrison, Anderson e Archer (2000)

Learning Design Templates

The evolution of education driven by online technologies and the need for interaction brought with them the first theoretical models of learning design. These models sought to develop learning structures and objectives, using conceptual and practical tools. There is no single conception, but interactions and complementation between models, which are tools for online education⁽¹⁶⁾.

Given the diversity of theoretical proposals and designs aimed at learning, the fulfillment of their objectives and the ideal use of technologies, discussions arise about the possibility of coexistence of these models and theoretical proposals in a single design. One of the approaches that stand out in this field is the mapping of tools and pedagogies that contribute to the implementation of learning designs by Conole, Dyke et al (2004)⁽¹⁷⁾, which addressed the multiplicity of theories present in the composition of learning environments and their various tools for developing learning activities. The mapping model consists of six components: 1) individual, where the individual is the focus of learning; 2) social: aimed at the development of learning through interaction and collaboration mediated by the speeches of its actors; 3) reflection, where directing this process to experiences is the basis of learning; 4) non-reflective: based on learning mainly focused on developing skills, conditioning and memorization; 5) information: where external structures make up the experience and knowledge material of learning; 6) experience: when learning develops directly from practical experiences and activities applied⁽¹⁷⁾.

Picciano (2009)⁽¹⁸⁾ presented a multimodal hybrid learning design composed of six fundamental pedagogical objectives and their respective implementations. These objectives encompass the delivery of content, social and emotional support through face-to-face contact between students and teachers, the dialectical/questioning approach, the promotion of reflection through reflective actions and group sharing, the facilitation of collaborative learning with tools such as wikis and, finally, the synthesis and evaluation module, considered most

relevant by the author. The latter is essential in the teaching-learning process and is supported by online teaching platforms, which enable transparency in the activity and in the assessment itself, in addition to maintaining a continuous record open to consultation.

In 2017, Picciano (2017) ⁽¹⁹⁾ revisiting his work, proposed an integrated multimodal model of online learning. The author adapts the assumptions of his hybrid model to the reality of Web 2.0, incorporating specific characteristics of online education, such as the concept of a learning community. Based on Wenger's theories, Iave (2008) ⁽¹⁴⁾, Garrison, Anderson and Archer (2000) ⁽¹⁵⁾, Picciano emphasized the importance of interactions as a central characteristic of this community. The main change consists of the inclusion of a seventh self-learning module, which promotes student autonomy in the learning process and allows the coexistence of self-study activities and objectives with other learning modules, often made available through adaptive software, being it is possible to observe its conceptual structure summarized in table 1 and its design in figure 2.

Table 1: Summary of the conceptual structure of Picciano's modules (2017).

Module	Concept
Content	Means of instruction through which information/knowledge is delivered.
Assessment	Instruments for measuring performance and learning evolution.
Reflection	Introspective and/or collective activity seeking to develop reflective teaching and learning.
Social and emotional support	The presence of the teacher or tutor to provide support to the student is inherent to learning as a social phenomenon.
Dialectic/Questioning	Based on the Socratic teaching method, it seeks to provide an environment for collective and participatory discussion.
Collaborative learning	Activities based on problem-solving by groups of students.
Self-directed study	Independent study, commonly offered through adaptive software.

Source: Picciano (2017).

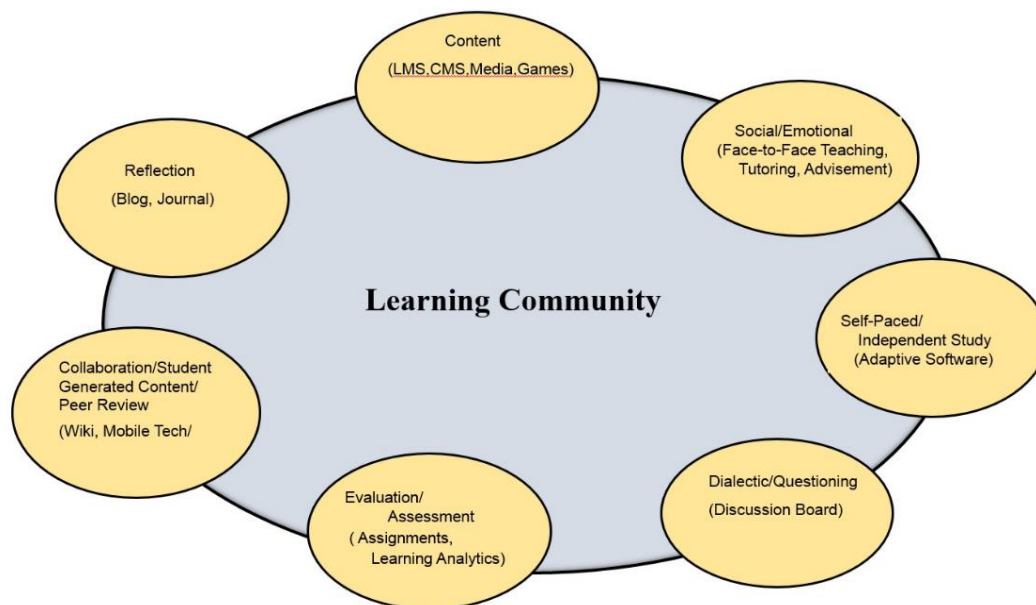


Figure 2: Integrated Multimodal Online Learning Model

Source: Picciano (2017)

Educational Interactions

The discussion about interaction in the educational process has gained relevance in the main learning design models. Moore's transactional distance theory (1986) ⁽²⁰⁾ considered interaction and knowledge transition as central elements of learning. The learning process is facilitated by reducing the transactional distance, focusing on the communicational variables: structure, dialogue and autonomy, conceptualized in Table 2, in this sense the transactional distance is reduced due to the presence and intensity of the dialogue, these variables being the first representations student interactions with the content, teacher and with the student or another student ⁽²¹⁾.

Table 2: Concepts of transactional variables from Moore's theory (1989)

Concept	Description
Structure	Teaching programs and learning goals, usually with objectives sensitive to the student's needs, but determined by the teacher.
Dialogue	Means of communication that allows easy and frequent interaction between student and teacher.
Autonomy	Learning process where the contents and goals are essentially determined by the learner and their interests.

Sources: Adapted from Moore (1989).

In subsequent studies, Anderson and Garrison (1998) ⁽²²⁾ highlighted the importance of interaction with content, especially with the increasing use of ICTs and the internet, including audio and video conferencing tools. The interaction takes place in a bidirectional way and involves teachers, content and students, highlighting three new types of interaction: teacher-teacher, teacher-content and content-content ⁽²²⁾.

Based on a critical analysis of the variables proposed by Moore (1986) ⁽²⁰⁾ flexibility is observed in its conceptualization, especially when considering Anderson's (2003) interaction equivalency theorem ⁽²³⁾ and Dron's (2006) transactional control model ⁽²⁴⁾. The first highlights the possibility of substituting forms of interaction in the educational process, depending on the context and learning objectives, without compromising pedagogical quality. The second argues that the variables' structure, dialogue and autonomy are interdependent, varying depending on who is in control of the educational process, be it teacher or student. However, Moore's (1986) conception ⁽²⁰⁾ faces methodological and empirical limitations, highlighted by Gorsky and Caspi (2005) ⁽²⁵⁾, mainly due to its reduction to a tautology, due to the inversely proportional relationship between dialogue and transactional distance. Despite limitations, the concept of interaction remains valuable and research continues to explore it over time. ⁽²⁵⁾.

Edu-Communication and Educational Products in Online Education

The importance of interactions in online education highlights the need for solid educational communication to achieve excellence in learning. Edu-communication, which involves the interdependence between communication and education, emerges as an interdisciplinary approach to carrying out this process. This encompasses interpersonal relationship and communication actions, management of educational technologies and the transformation of actors into producers within the social context. ⁽²⁶⁾.

One of its main tools for edu-communication is the educational product, understood as a resource aimed at facilitating the teaching-learning process, which should be thought of as an educational moment and not the mere transmission of information, having content representative of a multiplicity of discourses and not just centered on the knowledge of those who produce it, seeking to generate new knowledge ⁽²⁷⁾. Santos et al. (2019) ⁽²⁸⁾ described the CTM3 method for building educational resources, to reach their target audience as efficiently as possible, with the aggregate use of the theories of Transactional Analysis, Multisensory Application and Neurolinguistics. The first focused on the personality structures of Eric Berne's theory, the second involved the application of sensory elements in the structuring components of the resource and the third based on the inclusion of anchors in the product, through subliminal communication approaches based on neurolinguistics ⁽²⁸⁾. Therefore, edu-communication has become an important link in structuring online teaching-learning processes, as self-directed learning activities become part of the everyday educational context, giving greater weight to how asynchronous communications are structured to meet your educational goals ⁽²⁶⁾. Faced with the need for a new look at online learning aimed at designers integrated with interaction, learning theories and edu-communication, the present study was carried out, which resulted in the development of an online teaching-learning design oriented towards edu-communication and interactions.

METHODOLOGY

This is a descriptive and exploratory study, aimed at deepening and improving the field of online teaching-learning design, through the Integrated Mixed Research Strategy (EPMI), which uses multiple qualitative methods: qualitative meta-synthesis, content analysis and design thinking ⁽²⁹⁾.

EPMI consists of five stages:

- 1- Identification of the problem and objective of the study - definition of the theme, problem and objectives of the research;
- 2- Survey of a brief theoretical framework - structuring a theoretical foundation, not comprehensive, that allows a first contact with the theme to be worked on;
- 3- Qualitative field study - through a qualitative meta-synthesis, adapted from Matheus (2009) ⁽³⁰⁾, in six steps: Identification of interest in the study topic and the research objective; Selection of relevant content; Reading and re-reading data to identify relevant content; Presentation of the relationships between the content and its results; Making broad and well-founded statements and preparing a new interpretation ⁽³¹⁾;
- 4- Association of techniques – for the analysis of content from the qualitative meta-synthesis, Bardin's content analysis (2016) was associated with it. ⁽³²⁾, in three steps: Pre-analysis; Exploration of the material and, Treatment of results;
- 5- Elaboration of the online teaching-learning design prototype - the Design Thinking (DT) method was used, considering its systematic proposition of solutions to educational problems, especially with the use of ICTs, using the conception of Farias and Mendonca (2021) which structures DT into the following phases: immersion, analysis and synthesis, ideation, prototyping and product.

RESULTS AND DISCUSSION

Steps 1 and 2 - Identification of the Problem, Objective of the Study and Survey of a Brief Theoretical Framework

In everyday educational practice, the organization of activities must be based on pedagogical objectives, and the structuring of these activities can be anchored by learning designer models. With the diversity of tools available, for use in both face-to-face, hybrid or online teaching, associated with the concept of Edu-communication, described by Soares (2011), as an appropriate set of initiatives to facilitate social dialogue, through the conscious use of technologies of information and also considering the need for education to join communication, favoring enriching pedagogical actions, the question arises which design model could have a greater scope, covering interactions and Edu-communication? The advent of the pandemic in the years 2020-2021 further deepened the discussion about educational design that was guided by educational communicative practices. Thus, the objective of the present study was to develop a teaching-learning design prototype oriented toward edu-communication and online interactions.

The brief theoretical framework is included in the introduction of this study, and it is worth highlighting that in this process it was possible to observe the magnitude of the problem that generated the guiding question of the research because, given the immersion in the main theories and online educational models, a methodological gap was noticed in the procedure of construction of these processes and their implementation, especially about the orientation of the communicational and interactional process, which to date present empirical limitations ^(25; 29).

Qualitative Field Study

For the qualitative field study stage, which aimed to reframe best practices in the online educational field, a qualitative meta-synthesis was carried out. After applying the research strategies and carrying out searches in the databases, reading their titles, abstracts and first reading of the full text, we reached a total of 27 studies that had discussions related to the themes of learning theory, learning design, interaction and edu-communication in the field of online education ⁽³¹⁾.

Subsequently, the studies were submitted to the free data analysis software KHCoder, a tool used to code documents and analyze social research data, incorporating textual content analysis strategies, where the frequency of the main terms used in the studies and the extent of co-occurrences between these terms, measured by the Jaccard index that quantifies the intensity of relationships between terms. It was observed that the research descriptors are among the twenty most frequent terms in the results of the articles examined, also highlighting the frequency of emerging terms in the descriptors, such as "students", "environment", "collaboration", "development", "motivation" and "process". These terms support the understanding of the online teaching-learning configuration, where learning occurs in a collaborative environment, emphasizing the student's protagonism and motivation and their effective participation in the process ^(13; 33; 31; 12).

Regarding co-occurrence, a new prominence of descriptors was observed in 4 interconnection networks, covering the majority of occurrences. Furthermore, it was possible to identify points of convergence based on theories in the field, such as the connection mediated by the co-

occurrence of the terms "collaboration" and "communication", and a 40% co-occurrence between "e-learning" and "interaction", and rates ranging from 33% to 50% among other networks and terms. These factors reinforce the view of online education as a structure mediated by online interactions, which fundamentally depend on the quality of its content to stimulate effective communication in carrying out learning⁽³¹⁾.

Association of Techniques

After observing the main concepts covered by qualitative studies, through the notes given from the evaluation of frequency and co-occurrence indices, broad and well-founded statements were created that represent inferences based on the relationships presented between the results, in addition to supporting resignification of the concepts worked on in the meta-synthesis and consequently the structure of the model proposed in this study⁽³¹⁾.

Given this and to facilitate the reading of the main practices in the field of online education and its nuances, it was decided to structure two thematic categories presented below.

Online Learning Theories and Designs: In Search of Best Practices:

In the universe of research and development of learning theories and designs for online education environments, a systematic literature review was conducted by Valverde-Berrocso, Garrido-Arroyo, et al., (2020)⁽³⁴⁾, from 2009 to 2018. This study highlighted the need to promote student engagement and collaboration, effective facilitation, and teacher training as priorities in creating online learning environments. These priorities are aligned with terms often associated with online education, such as MOOCs, teaching-learning strategies, and interactive learning environments, as well as concepts such as Community of Inquiry (CoI) and Computer-Mediated Communication⁽³⁴⁾.

Despite the proliferation of studies and publications in the area of online education, the terminology used still lacks uniformity, with the term "online education" often interchanged with others such as "internet learning", "virtual learning" and "e-learning". However, all of these terms share the delivery of instruction through digital technologies, emphasizing the importance of interactions and collaborative environments in the educational process. The evolution of online education, from a geographically dispersed environment to asynchronous learning "anytime, anywhere," was influenced by information and communication technologies emerging in the early 21st century^(35; 36; 37).

A fundamental change in online educational models is the transformation of the roles of the actors involved. Students play more active and collaborative roles, while teachers act as mediators and facilitators. Based on this change, several theoretical proposals emerge to guide the learning process, addressing topics such as authenticity, adaptability, knowledge processing, modularization of content and its application in theoretical and practical activities, particularly in higher education policies^(38; 39; 40).

Furthermore, theoretical bases play a critical role, with the constructivist theory being widely applied in the development of online learning environments, according to Hutchins and Hutchison (2008)⁽⁴¹⁾ e Karasulu, Önal e Korukoğlu (2008)⁽⁴²⁾. Collaborative learning is another relevant approach, contributing to interactions⁽⁴³⁾.

The evaluation process plays a fundamental role in the development of online learning environments, with models for evaluating activities, communication contradictions, design and implementation. The ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model provides a framework for creating online learning environments, allowing for the selection of theories and designs according to learning objectives and adjustments based on assessments. Furthermore, promoting student autonomy and motivation in participation and collaboration is fundamental to the success of online teaching processes ^(41; 44).

In short, the definition of teaching-learning theories and designs must observe the desired learning objectives, with no exclusivity of approach in online education, however, some aspects are fundamental such as collaboration, motivation, proactivity, meaningful interaction and effective communication between all involved, with these last two areas of research being fundamental to the continued development of effective educational practices and designs.

Interaction and Educational Communication: Tools for Implementing Online Education:

The growing reality of online education essentially involved two actors - the teacher and the student - regardless of the learning theories or course models adopted. The effectiveness of these experiences depends on the interaction and communication between these actors to achieve learning goals ⁽⁴⁵⁾.

Moore's transactional distance theory (1989) ⁽²¹⁾ has emerged as a crucial basis for interactions in online education. Its variables unfolded in interactions between students, between students and teachers and between students and content.

The advent of personal computers and bandwidth communications in the late 1990s revolutionized interactions in online education, especially with the subsequent emergence of Web 2.0 technologies. This allowed for the ubiquity of interactions and collaborations, contributing to the advancement of online teaching and learning practices ^(35; 45; 46).

Although computer conferencing was one of the first proposals for online education, enabling interactions and knowledge construction, initial criticism often did not consider external factors that affect learning. Additionally, technologies such as wikis and social media, including blogs and tagging activities, have played important roles in student-to-student interactions but presented challenges in interactions with teachers ^(47; 48).

The recent pandemic has significantly impacted online education, with an increase in student use of smartphones for educational communication. However, more research is needed to validate these findings. Social media has also played an essential role in communication between universities and students. The inability of teachers to use these social media negatively influenced student participation, motivation and collaboration ^(49; 50).

Finally, the Theory of Learning and Teaching as Communicative Action (LTCA) offered a theoretical alternative for structuring educational actions that enable effective communication. She proposed different types of communicative actions aligned with learning objectives, presenting essential strategies such as feedback and usability to strengthen participation and collaboration. The modularization of content and representation through learning

objects/resources, although little addressed in studies, played a fundamental role in structuring asynchronous delivery models^(38; 51).

In summary, interactions and edu-communication play crucial roles in online education, seeking to overcome empirical limitations to promote effective communications mediated by information and communication technologies. This is critical to maintaining students' interest in online teaching and learning environments, which can be lonely in certain contexts.

Preparation of the Online Teaching-Learning Design Prototype

To develop the online teaching-learning design prototype, the Design Thinking method was used, specifically in the ideation and prototyping phases. In this sense, the theoretical structure of the Integrated Intermodal Model of Online Education will initially be designed and subsequently its graphic design, presenting the representative design of the interrelationships between the main theories and designs identified during the analysis of the study sample and their correlations with the approaches used. in the brief foundation, thus generating the Integrated Intermodal Model of online teaching-learning^(52; 53).

Ideation:

The analysis of data from the previous stage revealed the convergence between the concepts covered in the meta-synthesis and the authors referenced in the justification. Discussions about interactions and edu-communication demonstrated an intrinsic relationship with the effectiveness of teaching-learning designs.

Thus, the results pointed to the idealization of a learning model that would be characterized as open, integrative, collaborative, flexible and convenient, prioritizing student centrality, without adhering exclusively to a specific theory. In this model, students would play an active, critical and reflective role in the teaching-learning process, while teachers adopt a connectivism/collaborative approach, supported by ICTs. The focus is on promoting interactions, educational communication and the development of appropriate educational resources, in a comprehensive learning environment, with variation in educational product models, offering synchronous or asynchronous delivery activities and content, self-directed or community-based, provided that maintains an interactive, social, universal character and promote a disruptive learning model about face-to-face teaching^(54; 41; 43; 37).

The ideation of the prototype brought theoretical approximations with the approaches of Garrison, Anderson and Archer (2000)⁽¹⁵⁾, Wenger e Lave (1991)⁽¹⁴⁾ and Picciano (2017)⁽¹⁹⁾ regarding the structure of the teaching-learning process and its components, in the same way that the discussions are similar, and at times directly approaching, the connectivist and collaborative learning theories of Siemens (2004)⁽¹²⁾ e Harasim (2012)⁽¹³⁾, respectively, when considering knowledge acquisition and production strategies in the field of online education.

However, to be able to converge with such different approaches in the conception of an online teaching-learning design with a focus on interactions and edu-communication, it is necessary to initially recognize the convergences between the theoretical bases of these approaches. First understanding the relevance of Picciano's proposal (2017)⁽¹⁹⁾ by providing in its integrated model different pedagogical structures before the development and implementation of an online learning design, in addition to reinforcing the possibility of coexistence of actions and

structures of collaborative communities and individual learning in online educational environments.

However, different from what the author points out, the studies present not only an integrated coexistence between these pedagogical modules but an interdependence to the extent that it is not possible to separate, for example, the reflective learning process from the elaboration of its contents, mainly in the self-directed educational plans ⁽³⁴⁾.

It is worth highlighting that the conceptual structures coming especially from the Community of Inquiry and the Community of Practice, not only as a background, as occurred in Picciano's model (2017) ⁽¹⁹⁾, but reinforcing its main concepts as structuring an online teaching-learning design that is oriented towards interactions and edu-communication, mainly about the conceptualization of the presences of the CoI, which enable the representation of inflections between the pedagogical modules, providing an interrelationship between these, overcoming the integrated multimodal conception of the model. Likewise, the conception of situated learning and its construction of the effective participatory process in a collective and collaborative learning environment should guide the understanding and structuring of strategies for implementing educational interaction, as it converges to the propositions of authentic, adaptive and generative where interest and motivation in the topic contribute to participation and effective communication, impacting educational results ^(45; 15; 55; 14).

The effective application of ICTs is fundamental to Online Education and requires prior understanding to maximize the efficiency of two-way communication. The flexibility provided by ICTs in content models, encouraging participation and interaction favors collaborative and social learning, as well as ubiquitous communication. This even applies to self-directed learning models ^(6; 7; 34; 35).

A significant emphasis falls on interactions between students and teachers, requiring specific qualifications for teachers as mediators. When developing online teaching-learning designs, the presence of interaction structures contextualized with learning community models is essential. Although few methodological proposals are presented for structuring and measuring communication variables, the LTCA theory stands out, as it systematizes communication and determines types of communicative actions aligned with learning objectives. ^(51; 24; 56; 28).

However, when observing the discussions related to the implementation of edu-communication, it is useful to understand that such a structure must permeate the entire process of online educational communication, while this process is definitive for an effective and motivating online educational experience. In this sense, the CTM3 method, arising from the theoretical foundation, has a more robust methodological capacity than that provided by the LTCA theory, as it bases its methodological framework on three distinct and solid scientific bases, in addition to having evaluation strategies that allow validation of educational products that satisfactorily meet what the aforementioned method proposes, proving to be more efficient in achieving the objectives sought for a consistent online teaching-learning design ^(56; 28).

Likewise, the adoption of the concept of educational interaction presented by Moore (1989) is reiterated. ⁽²¹⁾, even with the questions presented, this approach is present in a large part of the

studies that discuss online education, regardless of its methodological limitations, even surpassing its updates, while interaction is still essential to the teaching process- learning carried out between student and teacher ⁽²⁵⁾.

In this way, we have the methodological guidance of CTM3 and the concept of transactional distance interaction as fundamental structures for understanding and designing the interactive and communicational process of an online teaching-learning design. While the first makes it possible to qualify the communicational reach of the products and resources available, an essential condition for a fundamentally textual educational process, as is the case with online education. The second allows us to understand, mainly with the conclusions arising from the equivalence theorem of interactions and transactional control, that this interactive process is fluid and robust enough to be carried out through its different possibilities, adapting to the determined pedagogical objectives ^(23; 15; 19; 28).

In the design process, it is essential to consider various communication strategies, as well as external factors that influence learning outcomes. Prior analysis of the conditions, usability, feedback and language of educational resources is essential. Therefore, online teaching-learning design demands strategic planning that incorporates theories, designs and activities aligned with the target audience and educational objectives. This covers all stages, from conception and design to implementation, usability, evaluation and feedback. ^(51; 41; 55; 44).

Thus, the Integrated Intermodal Model of online teaching-learning is based on the following conception: The online teaching-learning process essentially demands an efficient and robust interactional and communicative process so that it generates the desired pedagogical effects, therefore its entire process must be involved and guided by such phenomena, so Structure, Dialogue, Autonomy and Edu-communication are essential in this process. However, these variables do not fully encompass the construction of educational experiences, thus requiring strategies and tools for their implementation, highlighting the content as fundamental to guaranteeing the structure, and social and emotional support for dialogue and study strategies. individual for autonomy ^(20; 19).

Considering that such structures are not stationary, it is through the implementation of teaching, social and cognitive educational presences that interdependent relationships between the variables are made possible, where the first permeates and brings the educational structure closer to dialogue actions, mainly in the field of assessments that allow the identification of the effectiveness of the dialogue by measuring the knowledge acquired within the established didactic sequence. The second moves between the active participation of the subject and the pedagogical expectations established for such participation, standing out mainly for the reflective learning process after the search for effective participation that will be legitimized by the other actors and by the established educational structure. Finally, we have a cognitive presence, representing this dialectical and reflective process of online learning that puts us in contact with different conceptions of reality that leads us to absorb new realities on the topic addressed, leading us to re-signify these concepts. ^(15; 20; 19; 14).

Not forgetting to consider that all discourse designed within this process must be oriented towards the implementation of edu-communication, thus observing the choice of the best strategies, language, usability and accessibility of information to the different subjects who will

be able to reach them, considering their theoretical and methodological approach appropriate to the educational experience. Always considering the interaction between its subjects, with products and interfaces, within a culturally appropriate learning process, generating a sense of community through the motivation and common interest of its actors. Thus, generating a reflective educational experience ^(45; 20; 28; 14).

Prototyping and Graphic Design:

For the elaboration and graphic design of the prototype of the Integrated Intermodal Model of Online Education, it was decided to represent the constitution process through a procedural cycle that brings together the production phases presented by the ADDIE model and the CTM3 method, considering that both represent methodological propositions of building educational processes.

The ADDIE model is a classic instructional design model, featuring an evolutionary structure for creating online educational environments, with a perception of continuity between phases ⁽⁵⁾, as seen in the following figure:



Figure 3: Graphical representation of the ADDIE model

Source: Adapted from Bates (2017)

The analysis stage identified the internal and external variables for designing the teaching-learning process. In the design stage, the learning objectives, the media used to propose the content and the planning of the didactic sequence are determined. The development stage focused on the practice of building the planned tools, strategies and activities and the entire teaching-learning structure, while implementation represented the moment of preparation of educational actors and the practical disposition of what was designed and developed. Finally, we have the evaluation phase, which should focus on feedback and collection of data relevant

to correcting gaps detected in the implementation of the teaching-learning process designed. (5).

Observing the theoretical proposition of the ADDIE model, it is possible to identify that what was established as a conception by Santos, Warren *et al*(2019) ⁽²⁸⁾ in the CTM3 method extends to the analysis and design stages of ADDIE, representing the initial stage of an online teaching-learning design process, where the contextual, internal and external factors that interfere in the implementation of online education, the in the same way that seeks to define the general structures of the educational experience such as theme, objective, technologies, media, among others⁽⁵⁾. In the development process, the situation is reversed, with the theoretical and methodological reference stages of the CTM3 method covered by the development of the ADDIE model. In the case of the Integrated Intermodal Model, the last two stages were theory.

Considering that this is the process of developing educational products and resources that will be part of the entire educational context, it is essential to delve deeper into theoretical references that support the choices established in the conception, just as the need for guidance is imperative. methodological approach in the construction of these elements, aiming for better access and receptivity of information to be transmitted to your target audience ^(5; 51; 28).

Within the scope of this investigation, the design phase was approached in light of the integrated multimodal model proposed by Picciano (2017) ⁽¹⁹⁾, given its focus on structuring educational learning environments, playing a crucial role in the conception of online teaching-learning designs (Figure 4).

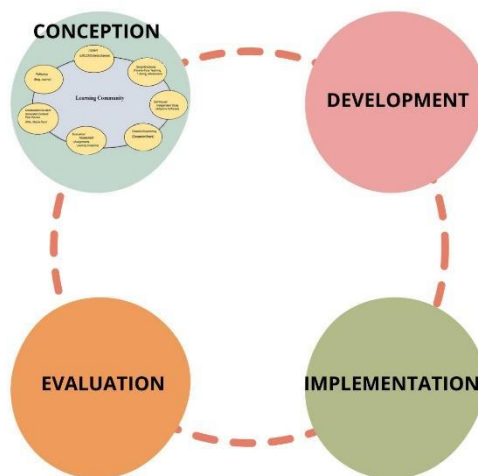


Figure 4: Representation of the design stage for an online teaching-learning prototype

Source: Own work

The structures of the integrated multimodal model are strongly related to Information and Communication Technologies (ICTs) and the activities that involve them, which can limit its conceptual description. However, by critically evaluating these structures, it is possible to identify their representations in communication variables. For example, reflection is related to the intersection of the variables structure, dialogue and autonomy, while content is part of the structure and represents the means of delivering information. Furthermore, self-directed study is a component of autonomy, while social and emotional support is linked to dialogue ^(21; 19).

All of these structures are permeated by the CTM3 method, which guides educational communication in all aspects, from structure design to the language used in autonomous learning environments. The integration of these approaches reflects the development of a learning design oriented towards interaction and edu-communication ⁽²⁸⁾.

Furthermore, considering online collaborative learning, based on network technologies, accessibility, ubiquitous communication and mutual collaboration, we realize that the configuration of an online teaching-learning design aligns with the conception of a collaborative learning community. Essential tools include dialogue as a broad means of communication and access to information, covering social and emotional support, as well as autonomy, which involves motivation, interest and self-directed learning. The structure, in turn, represents the instructional components, such as content, theme, objectives, activities, educational products and ICTs, adapted to the structure of the educational experience ^(15; 13; 21; 19; 14).

It is based on these inferences that the structure of the Integrated Intermodal Method is configured, as can be seen in the following figure:

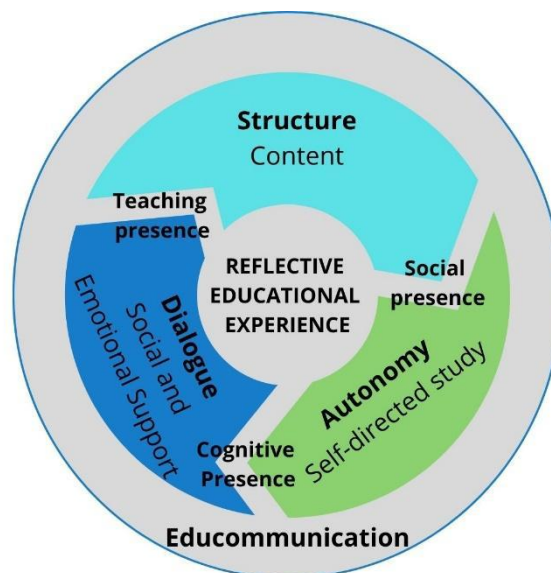


Figure 5: Integrated Intermodal Method.

Source: Author himself.

From here, the development stage is understood as a distribution of Picciano (2017) modules ⁽¹⁹⁾ products of interactions between Moore's communication variables (1989) ⁽²¹⁾, some of which are recognized as components of the presences defined by the CoI of Garrison, Anderson and Archer (2000) ⁽²⁵⁾. So, we begin to understand the development stage as follows:

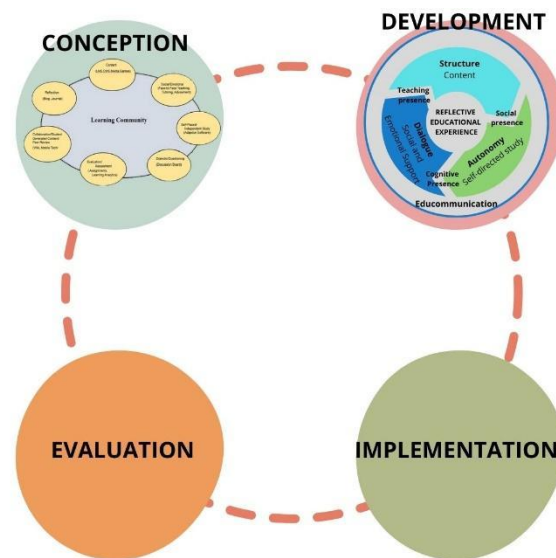


Figure 5: Development cycle of the Integrated Intermodal Model.

Source: Author himself.

Considering that the implementation is developed according to the structure foreseen for the designed educational experience, it is understood that there is no possibility of designating a fixed model for this, and it is therefore up to the designer to identify the preparation needs of his target audience and the teaching staff against the established design, to guarantee better effectiveness.

Subsequently, we have the evaluation stage, where the established design is subjected to feedback and data collection processes aimed at identifying weaknesses that may be remedied, which may generate changes in the design, development and, consequently, the implementation of the established model.⁽⁵⁾

In this sense, the need for evaluations related to different stages and structures of online teaching-learning design is understood. To this end, it is suggested to evaluate the communication structures of AVAs, the use of usability tests aimed at evaluating the quality of navigation, interactions and communication between the interface and its contents with users, from a perspective of satisfaction in navigability and efficiency and effectiveness of educational communication⁽⁴¹⁾.

From an evaluation perspective focused on the incidence of representative edu-communication actions, the possibility of using the LTCA theory is understood as appropriate, given its proposition of systematizing the communication of knowledge through the definition of 4 types of communicative action, which enables mapping of these types of action and their incidence record, which can be compared to the predictions established in the conception and development of the design⁽⁵¹⁾.

When considering the evaluation of teaching practices and their learning results, the use of mapping strategies of the approaches used during the design is considered relevant. In this sense, a possible model for identifying these factors could be Conole *et al* (2004)⁽¹⁷⁾ pedagogical mapping, given your understanding of the structure of learning.

CONCLUSION

After developing this entire journey of deepening the field of online education, especially in discussions related to the effectiveness of interactions and edu-communication, the structuring of online teaching-learning designs is understood as a process that involves a wide diversity of approaches that coexist within an educational structure. In this sense, the presence of each approach adjusts to the educational need, its objectives and the proposition designed for each of its activities and educational products.

However, when consulting the reality of approaches within qualitative experiences, it was possible to identify the existence of some of these in a paradigmatic position, making them inherent in the elaboration of any online educational context, namely transactional distance, communities of practice and inquiry and online collaborative learning. By correlating such approaches with current design models, the intrinsic relationship between them and Picciano's (2017) integrated multimodal model was identified. ⁽¹⁹⁾, based on this interrelationship between the approaches, it was possible to configure an online teaching-learning design that brings together the best practices used in the educational field, however, a lack was observed in the methodological field of edu-communication, found in the proposed CTM3 framework method to overcome this lack, from this confluence of proposals emerges the integrated intermodal model of online education.

The permeability existing in this model allows the designer to structure flexible and complex educational experiences, nevertheless aligned with a structural body of the online educational environment, where the entire experience is permeated by edu-communication and educational interaction. In this way, the teaching-learning process is understood as a multifactorial educational experience, determined mainly by its educational objectives and the experiences provided by the context in which it is inserted, also embedded in a collective and collaborative communicative and interactional process for the acquisition of knowledge common interest of its members.

In any case, this study demonstrated the possibility of planning and structuring a multiple, interactive and communicational online teaching-learning process with theoretical-practical support presented by the qualitative studies that provided the basis for its epistemological discussions, without preventing it from being reviewed, updated and mainly tested in practical experiences that confirm the inferences presented in its preparation. Therefore, it is important to highlight that the model requires additional replication, review, testing and validation.

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