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Abstract

The present article is the product of a study on the creation of didactic material for education mediated by health-applied technology. The study resulted in the specification of software requirements for the E-Dialogic (Dialogic Didactic Material Production System), a pedagogical solution that allows the content maker to deepen his or her knowledge on the dialogic language, as well as to carry out activities that will aid in the association, construction, and conversion of dialogic texts. In this context, it is sought to provide the information that is necessary for the development of the E-Dialogic, such as purpose, description, attributes, and requirements for the system's implementation, testing, and approval. The construction of the requirements specification document focused on developing a software capable of advising the content maker in the elaboration of the didactic material, thus reducing the production time and providing more interactivity and better quality for the material, since the system will guide the content maker in the didactic-communicational transition process, moving from the scientific text to the interactional-dialogic text perspective. The proposal of this system is the product of a masters research in a university located in the northeast of Brazil. With this work, it is intended to contribute to the elaboration of digital content for instructional and self-instructional courses, thus expanding the possibilities of producing materials that are more dialogic and effective for learning.

Keyword: Technology-mediated education; Production of Didactic Material; Dialogicity; Software Requirements

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The present article is the product of a study on the creation of didactic material for education mediated by health-applied technology. The study resulted in the specification of software requirements for the E-Dialogic (Dialogic Didactic Material Production System), a pedagogical solution that allows the content maker to deepen his or her knowledge on the dialogic language, as well as to carry out activities that will aid in the association, construction, and conversion of dialogic texts. In this context, it is sought to provide the information that is necessary for the development of the E-Dialogic, such as purpose, description, attributes, and requirements for the system's implementation, testing, and approval. The construction of the requirements specification document focused on developing a software capable of advising the content maker in the elaboration of the didactic material, thus reducing the production time and providing more interactivity and better quality for the material, since the system will guide the content maker in the didactic-communicational transition process, moving from the scientific text to the interactional-dialogic text perspective. The proposal of this system is the product of a masters research in a university located in the northeast of Brazil. With this work, it is intended to contribute to the elaboration of digital content for instructional and self-instructional courses, thus expanding the possibilities of producing materials that are more dialogic and effective for learning.

Keywords: Technology-mediated education; Production of Didactic Material; Dialogicity; Software Requirements Specification.

1. Introduction

Institutions have invested more and more in human training, facing the demands of the professional market. Alongside it, there is the growing need to create possibilities for the construction of specific consolidated technical knowledge. In addition to anticipating the development of new skills and improvements related to the work processes, the performance of activities, and the agility to use resources and various applications, it leads progressively to the search for high-quality courses and to the need to produce didactic material that meets these professionals' needs.

In this perspective, organizations and professionals have found in technology-mediated education the possibility of having a more flexible training, as well as a more significant contribution in the teaching and learning process, allowing the development of knowledge and skills with more autonomy. To this end, strategies such as the production and customization of teaching materials for virtual learning environments (VLEs) can have a great impact on the production of knowledge, on the provision of educational possibilities on a larger scale, on the integration of multiple media, languages and didactic resources, as well as on organized and interactive learning. In this context, dialogicity becomes essential to the production of didactic material for technology-mediated courses, since it is necessary to create communication strategies, considering the textual layout, the audiovisual resources and the other graphic elements that facilitate the learning process and reduce the cognitive effort.

In the VLEs, communication and dialogicity are the results of new ways of thinking and acting and play an indispensable role in teaching and learning. This way, a great challenge faced by the content maker is the production of didactic material using a dialogic language, that is, a language that makes the dynamic communication between student and digital content possible.

To contribute to the process of producing didactic material for technology-mediated education, this paper presents the specification of requirements for a software called the E-Dialogic (Dialogic Didactic Material Production System). The E-Dialogic is a proposal of a pedagogical solution for the content elaboration process that allows the content maker to deepen the knowledge on dialogic language; to make association between traditional texts and dialogic texts; to construct texts with dialogicity; to convert conventional texts into dialogic texts; to generate history; to access the activities that were performed; and to evaluate the system itself, saving the evaluation records on the server for later review by the owners.

2. Literature Review

2.1 Technological Mediation in the Human Formation

The technological mediation in the human formation allows autonomous learning, as well as the development of the professionals' critical and reflexive thinking on aspects of their realities, which are permeated by the interaction and the strengthening of learning in a process of constructing and applying knowledge and skills for the performance of competencies needed for professionals in different areas. According to Santaella (2013), it is likely that, from the educational point of view, mediating in the era of digital technologies implies facing the challenge of moving ingeniously between word and image, between books and digital devices, between emotion and reflection, between the rational and the intuitive, traveling

the path of critical integration and balance in the search for innovative, fun, motivating, and effective proposals.

It is in this context that technology-mediated education can favor the construction of the learners' autonomy since it requires better time organization and greater responsibility in learning. For Morán (2015), technology brings the integration of all spaces and times, with teaching and learning taking place in a symbiotic, deep and constant interconnection between what is called the physical and the digital worlds. Professionals who seek technology mediation to learn need efficient and effective proposals that contribute significantly to the education of individuals. Nunes (2009) states that, in the coming decades, a phenomenon that has been underway for at least 20 years, which is the integration between face-to-face and distance educations, will certainly be seen. The convergence between these two models of education already exists in several places, but it is likely to become the norm and common practice in all systems. Therefore, technology-mediated education presents itself, along with a growing and rapid scientific and technological advance, as a strong ally for professional education in the present day, generating constant needs for the construction and sharing of new knowledge. However, the real transformation will only be perceived through the democratization of actions and the expansion of critical thinking and strategies that contribute to the production of interactive and innovative didactic material, promoting the integrated development and the alignment between theory, practice, teaching, learning and technological mediation in human formation.

2.2 Production of Didactic Material for Technology-Mediated Education

With the new teaching and learning methodologies, technology-mediated education has become a possibility with great potential for achieving institutional objectives. It is not difficult to perceive the effects of this educational model, with the evident improvement of professional practices and the development of its protagonists. Technological mediation favors the breakdown of paradigms such as the conventional training that still exist in many institutions, confronting with the changes of thought about innovative possibilities of teaching and learning.

For Antunes et al. (2013), VLEs are intended to integrate and dynamize multiple media, languages, and resources. Thus, technological means will allow more significant interaction and conditions for the construction of meaningful knowledge, with interactive courses and virtual learning environments that are increasingly rich in educational possibilities, diverse media, and educational resources. The process of producing didactic material for technology-mediated education must follow a north that enables learning with instructional techniques of organization, selection, and categorization of information, and appropriate structure and language.

The production of didactic material for technology-mediated education must start from the needs and the demands that the professional field presents, with the didactic material contributing to the human formation and allowing the professionals to have flexible access to it, thus respecting his or her work routine. In this perspective, Ramos (2010) argues that the self-instructional course is a model of distance learning that differs from the others by guaranteeing the student's autonomy and independence through the use of self-explanatory materials. It has been intensively popularized in recent years for having all of its content

organized in a way that meets the participants' needs, observing the interest of professionals and offering knowledge with objectivity and simplicity.

Corroborating this thought, Fernandez (2008) asserts that the development of didactic material for distance education can be carried out in different ways and methods. Its various characteristics can be examined from the concept of education that the material follows, the assessment criteria, and the communication model on which the content approach is based.

Thus, the use of innovative methods that aim to reduce the time taken to develop content and to achieve the organization goals and the needs of the society are increasingly perceived in the production of didactic material for technology-mediated education. With this, it becomes essential to produce material from a didactic-communicational transition process, moving from the scientific text to the interactional-dialogic text perspective, thus giving visibility to the problematization, to the awareness, to the contextualization of everyday practices, to the technology-mediated education, to the qualified and transformative professional performance and to the improvement of the services offered.

2.3 The Dialogicity in the Context of Technological Mediation

Virtual learning environments are platforms that allow the integration of multiple media, languages, and didactic resources that can promote learning in an organized and interactive way. The communication and dialogicity in VLEs result from new ways of thinking and acting, playing an indispensable role in teaching and learning in these environments.

The interaction in technology-mediated education presents a different relationship between student, teacher, and content since they are separated by physical and logical interfaces. For Moore (2007), it is the physical distance that leads to a communication gap, a psychological space of potential misunderstandings between instructors and students who need special teaching techniques. Thus, dialogic education is indisputably an ally, using both interactivity and the role of the student, who actively contributes to his or her own learning process.

For Freire (2015), knowledge requires the presence of the subject facing the world and his or her transforming action on the reality in a constant search, resulting in the intervention and reinvention. Concerning the production of content for technology-mediated education and dialogicity, it is necessary to create strategies for better preparation of the professionals who submit to this purpose, offering them the knowledge needed for the critical reflection on their practice.

Still according to Freire (2015), it can be affirmed that true education only exists if there is communication, and communication only exists if there is dialogue. In the case of technology-mediated education, this dialogue must take place between the student and the content in a self-instructional interaction. Complementing, Belloni (2015) states that the role of the teacher is crucial to the success of present or long-distance education processes and his/her performance will tend to shift from the wise monologue of the classroom to the dynamic dialogue. It is in this sense that the pedagogical practices in VLEs should bring a transparent delineation of respect for the students' autonomy, which is fundamental in the production of didactic material for technology-mediated education, as well as in the teaching and learning process.

According to Volli (2007), the enunciation marks in the text are significant for the analysis in many aspects, as indications of the ways the subject is manifesting him or herself, the way he or she assumes his utterance, and the ways the enunciator, the enunciate and their relations are inserted in the text. Understanding is a form of dialogue; it stands for the enunciation just as a replica stands for the other in the dialogue (BAKHTIN, 2012). Thus, content for technology-mediated education must have its own characteristics and who determines how these characteristics will be arranged are the content makers since they need to write thinking about the student and for the student, understanding that teaching and learning will happen through their interaction.

In this context, the pedagogical practice takes place through a dialogue between teachers that make the content, students and didactic material in an interactionist, virtual and dialogic perspective, which takes shape from the planning to the conception of the content, from the text structure to the way in which the activities are made available in the VLEs, strengthening itself through the anticipation of doubts, articulated questions, suggestive possibilities, restlessness, discoveries, constructions and interactive challenges.

3. Specification of Software Requirements

This work is part of a study that elucidates the importance of technological mediation in human formation, the difficulties faced in the production of didactic material for technology-mediated education and the use of the dialogic language. This way, the E-Dialogic (Dialogic Didactic Material Production System) Software Requirements Specification is presented as a product, providing the necessary information for the design, implementation, testing, and approval of the system.

The software requirements specification is a thorough, consistent, and complete description of the software using a suitable language. A software specification is an abstract model of this product. In this work, the Unified Modeling Language (UML), written by Grady Booch, Ivar Jacobson, and James Rumbaugh, and proposed by the Object Management Group (OMG) as the standard for software system modeling will be used. With it, one can specify, visualize, construct and document projects from diagrams, that is, from a standardized representation of the system to be developed, facilitating the understanding of what one wishes to implement. It is the systematic and abstract description of what the software should do from what has been analyzed, presenting the solution to the problems raised, and describing the functional properties necessary to solve them.

The requirements are the goals or constraints that define the various properties of the system, specifying what the system should do and determining the validation criteria that will be used to evaluate if it complies with what was established (LEITE, 2019).

In this sense, according to OMG (2019), UML is the most widely used specification language. It helps to model the structure, behavior, and the architecture of the application, as well as processes and data organization. When specifying the requirements of a system, it is necessary to take into account the wishes and satisfaction of future users and the properties of the system that will be developed.

4. E-Dialogic

4.1 The System

The E-Dialogic is a proposal of a pedagogical solution for the process of producing didactic materials for technology-mediated education, which will allow the content maker to navigate through its functionalities, to deepen the knowledge about dialogicity and to obtain subsidy in the production of dialogic content.



Figure 1. Layout suggested for the E-Dialogic login screen.

Source: Designed by the author, 2019.

In Figure 1, it is possible to see that the E-Dialogic offers, in its login screen, online help through the ED, the system's virtual assistant, who will interactively assist the user during his or her navigation and that can be deactivated and reactivated whenever the user feels the need. Also, in the login screen, the User Guide is found, which will allow the user to access online help through detailed information on the use of the system. In Table 1, the functional requirements of the login screen are presented with their description and requirements.



Figure 2. Layout suggested for the E-Dialogic user screen.

Source: Designed by the author, 2019.

In Figure 2, the layout suggested for the user screen is shown, where the functions of the Dialogic Didactic Material Production System can be found. In Table 1, the functional requirements of this screen are presented.

With the E-Dialogic, the content maker can reduce the time taken to write the texts, producing didactic material with more interactivity between the student and the content. It is an online system that can be used on desktop computers, notebooks, and mobile devices. tex

4.2 Use Case Diagram

The use case diagram can be elaborated to facilitate the understanding of the various parts that make up the system, allowing the visualization, specification, and documentation of the software requirements. In UML (2019), it is found that modeling is the design of software applications before coding. It is an essential part of large software projects and is also useful for medium and small projects. Using a model, those responsible for developing a particular software project can ensure that the functionalities and the end user's needs are met. This way, modeling increases the system's chances of success, being a way to visualize a particular project and check the requirements before coding.

Following this context, use case diagrams can specify the functional and non-functional requirements of the system. With the functional requirements, it is possible to have a description of the software functions desired by the users and necessary to perform certain activities. The non-functional requirements are the general characteristics of the software, among which are the maintainability, usability, and performance.

In a use case diagram, it is possible to encompass the use cases themselves and the actors involved, as well as the dependency relationships, generalization, and associations.

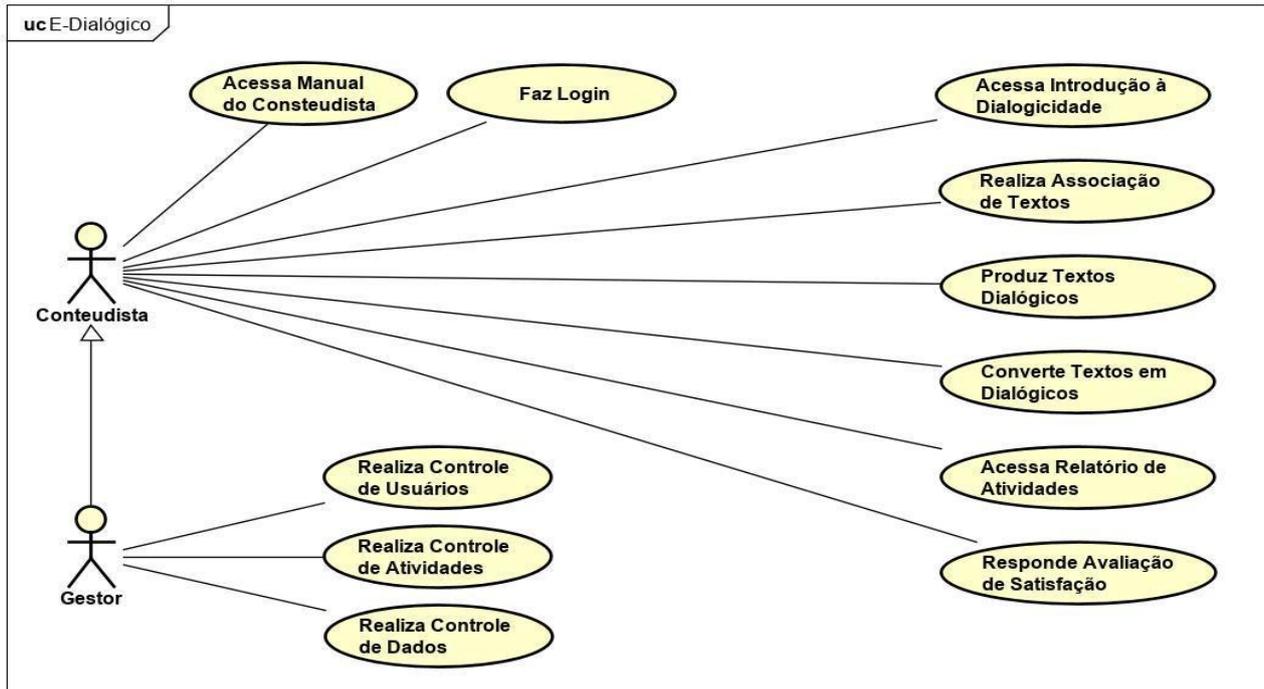


Figure 3. Use case diagram of the E-Dialógico system.

Source: Designed by the author, 2019.

Figure 3 shows the use cases of the E-Dialógico system in a diagram built using Astah, a software that contributes to the process of constructing and visualizing diagrams and that can be found in the Professional, UML, GSN, SysML and Viewer versions. In this study, we chose to use Astah's UML version since it is a lightweight version with an integrated mental mapping resource and offers a Free Student Academic License (ASTAH, 2019).

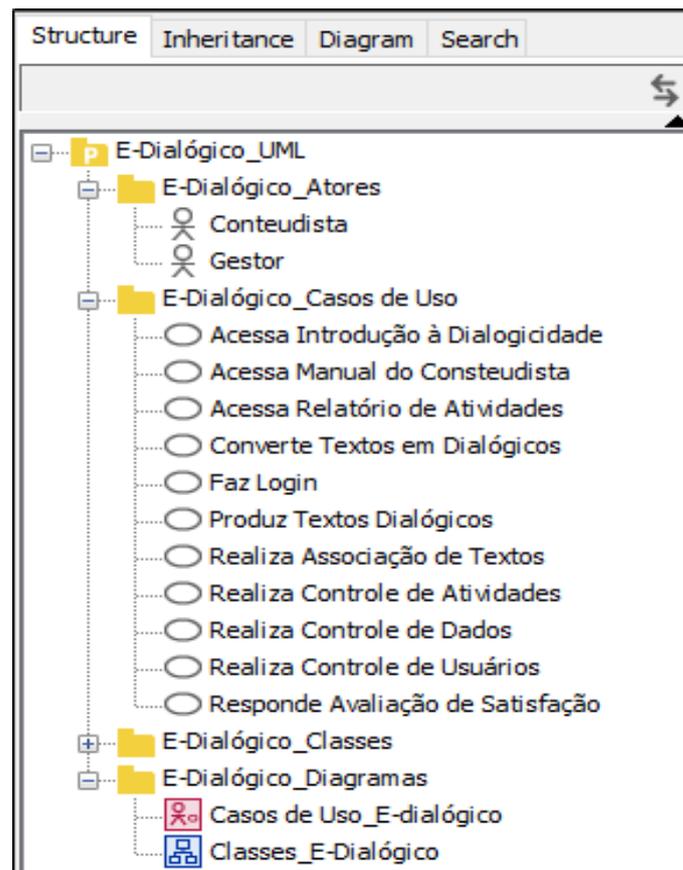


Figure 4. Part of the structure of the E-Dialógico system.

Source: Designed by the author, 2019.

The E-Dialógico will have as actor the content maker user, who has permission to use the Content Maker Guide, the Introduction to Dialogicity, and Association Between Conventional Texts and Dialogic Texts, the Production of Dialogic Texts, the Conversion of Conventional Texts to Dialogic Texts, the Activities Report and the System Satisfaction Evaluation features. The content maker can view his or her system use history, return to previous activities, and generate files in PDF format. The system will also have the manager user actor, who can access the Control Other Users, the Control Data and History of Access, and the Statistical Control of the Satisfaction Evaluations features, and who will also inherit all of the use cases available to the content maker user. The manager user interface will not be visible for registration, having its permissions released only by the system owners.

4.3 System Requirements

In the specification of software requirements, both functional and non-functional requirements are established, and there may be use cases to describe the interactions between users and the system. According to Fiorini (1998), the requirement is a condition or qualification that a system or a component of a system must meet or have to satisfy a contract, a standard, a specification, or another formally established document. It is the set of all requirements that form the basis for the further development of the system or a component of it.

Requirements may be aspects or constraints of the software and must provide developers, designers, and

testers with the information they need to estimate the cost and time to build the system. In this work, we present the requirements with an identifier (ID), a name, and a description, as well as the priority of each requirement, which can be classified as essential (E), important (I) or desirable (D).

4.3.1 Functional Requirements

Functional requirements relate to what the system must do, such as its functions and information. They are directly linked to the system's functionalities, services, and behavior.

Table 1. E-Dialogic's Functional Requirements

FUNCTIONAL REQUIREMENTS - GENERAL			
ID	Requirement Name	Description	Priority
FR01	User registration	Allow system user registration and maintenance.	E
FR02	User profile	Sort users as Manager or Content Maker according to the desired profile. Each user cannot have more than one profile.	E
FR03	User control	Allow the Manager user to create, change, and delete system users.	D
FR04	Activity control	Allow the Manager user to perform statistical control of the system's satisfaction evaluations.	D
FR05	Data control	Allow the Manager user to control data and system access history.	D
FR06	Discussion forum	The system should provide the creation of discussion forums for the Content Makers and the Managers users.	I
FR07	E-Dialogic chat	The system should provide a chat for system users. The chat can be started when two or more users are logged in.	I
FR08	Source code control	The system should provide information about the current version of the source code.	E
FR09	Type of license	Provide information about the type of system license. The system should display a footer with its license/copyright information.	D
FUNCTIONAL REQUIREMENTS - LOGIN SCREEN			
FR10	User	User login identifier. The field is mandatory and unique per user. Up to 20 alphanumeric characters can be used, always with lowercase letters. It should contain a name followed by a	E

		period and the last name (example: erivaldo.santos).	
FR11	Password	User access password. Field with 06 alphanumeric characters, mandatory and unique per user. Only lowercase letters should be accepted.	E
FR12	User guide	User's guide. Online file access command.	D
FR13	Log in	Access command to the user screen. It is a function.	E
FR14	Recover user	Access command to the user recovery screen. The Content Maker must inform the registered e-mail. The system will send a message informing the user's name and password.	I
FR15	ED	Virtual assistant. Command that can be activated or deactivated by the Content Maker user during navigation.	D
FR16	Exit	Closes the system (browser window). Command always valid on this interface.	E
FUNCTIONAL REQUIREMENTS - USER SCREEN			
FR17	Profile	Access command to a screen that allows the user to change his or her basic data (username, password, and profile picture).	I
FR18	Introduction	Online interface presenting brief clarifications on dialogicity. Interface access command "What is dialogicity?"	E
FR19	Association	Allows the user to access an interface containing 05 exercises related to the association between conventional texts and dialogic texts.	E
FR20	Production	System interface that will allow the user to access an interactive text editor. The "ED" will assist in the construction of dialogic texts.	D
FR21	Conversion	System command that will allow the user to access a screen for the conversion of conventional texts into dialogic texts. Contains one field for typing and another for the dialogic text suggested by the system.	D

FR22	Report	Allows the user to access an interface with the history of activities performed. The user will be able to view his or her system usage history, return to the activities performed before, and generate files in PDF format.	I
FR23	Satisfaction	Access command to the system's usability, reliability, and compatibility satisfaction evaluation interface. Each user registered will be obligated to respond to the evaluation in his or her first access. It can generate a PDF format file of the evaluation. The evaluation records will be saved on the server for further review by the developers.	E
FR24	ED	E-Dialogic virtual assistant, who will accompany the user during navigation. It can be deactivated and reactivated whenever the user feels the need.	D
FR25	Exit	Command that allows to exit the user screen into the login screen. A function that is always valid in this interface.	E

Source: Designed by the author, 2019.

4.3.2 Non-Functional Requirements

Non-functional requirements are nothing more than qualification criteria for functional requirements, such as performance, usability, reliability, system robustness, and others. They define the system's properties and constraints such as time, space, programming languages, Operating System, method of development, etc.

Table 2. E-Dialogic's Non-Functional Requirements.

NON-FUNCTIONAL REQUIREMENTS			
<i>ID</i>	<i>Requirement</i>	<i>Description</i>	<i>Priority</i>
NF01	Web system	It should be a web system. It will be a responsive system that can be used on desktop computers, notebooks, and mobile devices.	E
NF02	Developed in JavaScript and HTML	The system should be developed using HTML and JavaScript.	E
NF03	Compatible with all major browsers	The system must support all major web browsers (Chrome, Firefox, and Microsoft Edge).	I

NF04	Responsive	The system should work on any device that has a compatible web browser.	I
NF05	Register log	Record all actions performed on the system.	D
NF06	Security	Only one registration will be allowed for each user. The system must identify and restrict new registries for existing users.	I

Source: Designed by the author, 2019.

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5. Conclusion

This study summarizes the presentation of the E-Dialogic requirements specification. It is sought to achieve an efficient, easy-to-use system that effectively assists the content maker in the production of dialogic didactic material with resources that favor the elaboration of high-quality content for technology-mediated education.

In long-distance education, unlike the face-to-face classroom, VLEs help in the course of the study and learning process, where the interaction is built between man and machine, student and digital content, in a process in which dialogicity is essential and enriching, facilitating the understanding of the proposed themes. Given this, content personalization can significantly influence learning, and the use of dialogic language enables innovative interaction and enhances the relationship between student, content, and virtual environment.

This way, this paper discusses a proposal of a pedagogical solution to assist in the process of elaborating didactic material for technology-mediated education, allowing further studies on the development, implementation, testing, and approval of the tool to be carried out later.

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