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ARTICLE

USING CONTENT ANALYSIS IN THE DEVELOPMENT OF AN EDUCATIONAL SOFTWARE: A CASE STUDY FOR TEACHING ABOUT ACADEMIC PLAGIARISM

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ABSTRACT: The key to software development is to be able to grasp users'/customers' needs. Thus, interaction with users/customers is extremely important. The objective of this work is, through a case study, to share the experience in the process of deriving the requirements of an educational tool/software using the technique of content analysis, bringing relevant information about the need, and the importance of the involvement of the user in the new products development process. To this end, we sought from the literature the best practices in the process of developing new products, detailing the importance of user/customer participation. Then, we conducted interviews with a group of potential users of the proposed educational tool, to clarify the following question: "What should an educational tool for teaching about plagiarism have to promote learning?" and, subsequently, the content analysis of the interviews. In this way, we could identify the most relevant contents in teaching about plagiarism to be treated by the tool and the pedagogical approaches, i.e., the didactic strategies used by teachers. The interviews were also essential sources to identify teachers' needs and suggestions about the educational tool/software.

Keywords: Academic plagiarism, Users/customers, Educational tool/software, New product, Requirements derivation.

UTILIZANDO ANÁLISE DE CONTEÚDO NO DESENVOLVIMENTO DE UM SOFTWARE EDUCACIONAL: UM ESTUDO DE CASO PARA O ENSINO SOBRE PLÁGIO ACADÊMICO

RESUMO: A peça-chave para o desenvolvimento de um software é conseguir extrair dos usuários/clientes as suas necessidades. Para isso, a interação com os usuários/clientes é de extrema importância. Nesse sentido, o objetivo deste trabalho é, através de um estudo de caso, compartilhar a experiência no processo de derivação dos requisitos de uma ferramenta/software educacional, utilizando a técnica de análise de conteúdo e trazendo, com isso, informações relevantes sobre a necessidade e a importância do envolvimento do usuário no processo de desenvolvimento de novos produtos. Para tanto,

buscou-se, em primeiro lugar, na literatura pertinente, as melhores práticas desse processo, detalhando a importância da participação dos usuários/clientes. Em seguida, foram realizadas entrevistas com um grupo de potenciais usuários, no caso os docentes, da ferramenta educacional proposta, a fim de esclarecer a seguinte pergunta: "o que uma ferramenta educacional para o ensino sobre plágio deve possuir para promover a aprendizagem?"; e, posteriormente, foi feita a análise de conteúdo das entrevistas. Dessa forma, foi possível definir os conteúdos mais pertinentes ao ensino do tema do plágio, para serem tratados pela referida ferramenta, além das abordagens pedagógicas, ou seja, as estratégias didáticas utilizadas pelos docentes para o desenvolvimento desse tema com seus alunos. Além disso, as entrevistas se mostraram como fontes fundamentais para a identificação das necessidades e sugestões dos docentes acerca da ferramenta/software educacional.

Palavras-chave: Plágio acadêmico, Usuários/clientes, Ferramenta/software educacional, Novos produtos, Derivação de requisitos.

UTILIZAR EL ANÁLISIS DE CONTENIDO EN EL DESARROLLO DE UN SOFTWARE EDUCATIVO: UN ESTUDIO DE CASO PARA LA ENSEÑANZA DE LA PLAGA ACADÉMICA

RESÚMEN: La clave para el desarrollo de software es poder extraer las necesidades de los usuarios/clientes. Por lo tanto, la interacción con los usuarios/clientes es extremadamente importante. El objetivo de este trabajo es, a través de un estudio de caso, compartir la experiencia en el proceso de derivar los requisitos de una herramienta educativa utilizando la técnica del análisis de contenido, aportando así información relevante sobre la necesidad y la importancia de la implicación del cliente en el proceso de desarrollo de nuevos productos. Para ello, se buscó en la literatura las mejores prácticas en el proceso de desarrollo de nuevos productos, detallando la importancia de la participación del usuarios/clientes. Luego, fueron hechas entrevistas con un grupo de potenciales usuarios de la herramienta educativa propuesta, con el fin de aclarar la siguiente pregunta: "¿Qué debe tener una herramienta educativa para la enseñanza del plagio para promover el aprendizaje?" y, posteriormente, el análisis de contenido de las entrevistas. De esta manera, se logró definir los contenidos más relevantes en la enseñanza sobre el plagio, a ser tratados por la herramienta, además de los enfoques pedagógicos, es decir, las estrategias didácticas utilizadas por los docentes. Además, las entrevistas fueron fuentes fundamentales para identificar las necesidades y sugerencias de los docentes sobre la herramienta/software educativo.

Palabras clave: Plagio académico, Usuarios/clientes, Software educativo, Nuevos productos, Derivación de requisitos.

INTRODUCTION

Currently, innovation has become, admittedly, a decisive factor for the success of organizations, being essential for obtaining competitive advantages. The potential to innovate, respond quickly, and develop innovations in an increasingly shorter time frame requires the ability to efficiently drive internal and external competences (TIDD; BESSANT, 2015). Organizations are looking for external sources that can collaborate and participate in the innovation process, so their customers are the main actors in this process, playing an important role in the development of new products. The identification and involvement of customers, at the right time, can contribute to the innovation process, facilitating the identification of opportunities, helping the development of new products, and helping organizations to sustain long-term competitiveness (LETTL; HERSTATT; GEMUENDEN, 2006).

Customer involvement has already been discussed by authors such as Von Hippel (1988) and Lettl, Herstatt, and Gemuenden (2004), who mention it in the process of developing different types of new products. In software development, for example, there are at least three ways to involve the user/customer in the process: the first is through requirements gathering, the idea generation phase, which consists of understanding the needs, possibilities, and restrictions of the tool that will be developed; the second way is to include the user in the prototype development phase; and the third can occur in the validation, in the first tests of the future tool.

In the work of Bassani, Passerino, Pasqualotti, and Ritzel (2006), a methodological proposal is presented for the development of collaborative educational software, which has its specificities, unlike commercial software, in which the results are reflected in the external environment. Educational software stands out in terms of internal user change, which has long-term results that are very difficult to measure. In the first activity, requirements gathering, the authors consider important a project centered on the users of this tool (students, teachers, and school actors in general). They define that the requirements gathering stage of educational software are characterized by the specification of the methodology, determination of the type of software (exercise, tutorial, game, etc.), the definition of the target audience, extension of the content, and the possibility of collaboration.

For the development of educational software, it is necessary, initially, to listen and have as evaluators the teachers who will use this tool to help the teaching-learning process of the students. Therefore, if customer needs are not properly understood in the initial phase, they can lead to the failure of the product in the market (GONZÁLEZ; TOLEDO; OPRIME, 2012).

This study aimed to raise requirements for the development of interactive educational software, teaching and also evaluating students on the concepts of academic plagiarism, procedures to avoid it, and awareness of professional and academic ethics. Thus, involving teachers in the initial phase of this process, which is the collection of raw information and its transformation into the specification of requirements, is of paramount importance for the development of this educational tool.

In this way, using the development of a case study, we seek to share the experience and the process of deriving the specification requirements of the proposed educational tool, bringing relevant information about the need and importance of user involvement in the new product development process.

This article is organized into five sections: introduction, theoretical reference, methodology, presentation, and discussion of results, in addition to final considerations.

THEORETICAL REFERENCE

This work is based on the innovation management process, new product development processes, and software development process models. These concepts will first be clarified, and then we seek to apply these concepts and share the experience of the process of deriving the requirements of the proposed educational software/tool.

Innovation management process

"Innovation" does not happen by chance, it "is a process created by taking an idea forward, revising and refining it, creating a useful product, process or service" (TIDD; BESSANT, 2015). Generically analyzing innovation, as a process necessary for all organizations and fundamental for the survival and growth of organizations, Tidd and Bessant (2015) elaborated the following innovation process, which tends to be common to all companies:

- Search – a fundamental part of the innovation process, in which the scenario (internal and external) is collected and analyzed in search of opportunities to place a new product or service on the market.
- Select – the search phase brings countless possibilities of what can be done. In the selection phase, there is the challenge of building an innovation strategy for the organization, analyzing the alternatives, choosing where to invest resources, and planning how to do the innovation happen.
- Implement – at this stage, there is the challenge of transforming an idea into a successful product, translating the initial idea into something new, until its launch in the domestic or foreign market.
- Capture – in this phase, we analyze how to ensure value capture with innovation, and the associated benefits of the effort to innovate, both related to commercial success ("generating profits", reducing costs) and to the issue of "social entrepreneurship", which is more concerned with creating social value, that is, creating a change in the world. There is also a concern to creating adaptable learning and approach so that the organization can build its knowledge base, creating capabilities and routines necessary for the effective management of innovation and improving how the process is managed.

This complete process is represented in Figure 1.

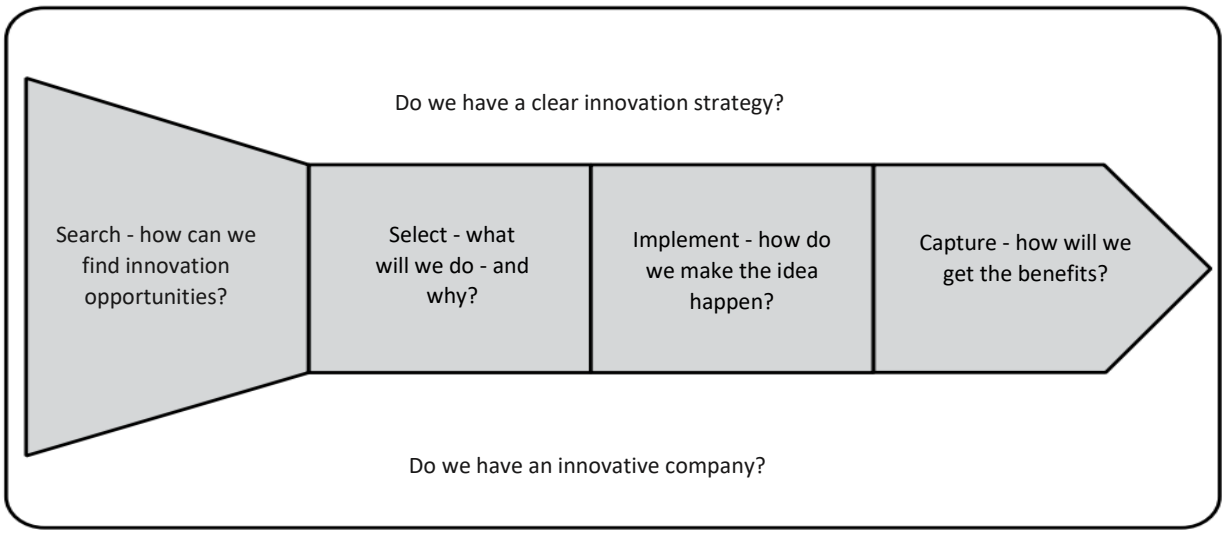

FIGURE 1 - Model of the innovation process

Source: Tidd and Bessant (2015).

Product development process models, such as the Stage-Gate approach, by Cooper (2001), the model by Ulrich and Eppinger (2008), and the Lean approach, are some of the processes that guide the implementation of innovations.

Next, we detail the involvement of customers in the new product development processes.

Customers in the new product development process

Listening to users is extremely important, however, it is not always easy to translate their needs and wants into products or services. Several authors have discussed, in the literature, the participation of customers in the process of developing new products. One of these authors is Von

Hippel (1988), who, after years of research, describes, in his study, the role of leading users in innovation, providing useful guidelines to identify these users. The author links the term "leading users" to those users who set market trends and who benefit from obtaining a solution that meets their needs. In another study, Von Hippel (2005) presents several cases in which customers were the main source of innovation. Lettl, Herstatt, and Gemuenden (2006) also discussed the contribution of customers in the project for the development of medical-hospital equipment.

Customer/user participation is an important factor described in models considered references in the area of product development, such as the model by Ulrich and Eppinger (2000) and the Stage-Gate model by Cooper (2001). Although these models are useful for any product development, they focus on the development of physical products, not emphasizing the specific problems involved in software development. Even with this certain limitation, in this study, these models were analyzed to detect the best practices adopted to identify the needs of customers/users, since they can apply to software development, contemplating situations inherent to this process.

The following is a description of customer participation in these reference models. Finally, in the theoretical foundation, the Lean approach, created by the Toyota company, and the models of the software development process are exposed. Knowing the Lean approach will help us better understand how agile software development methodologies emerged.

New product development processes

Ulrich and Eppinger model

According to Ulrich and Eppinger (2008), the product development process is the sequence of steps that the cross-functional teams of a company, working together, must follow to conceive, develop and commercialize a product. This process can be divided into six phases, as shown in Figure 2.

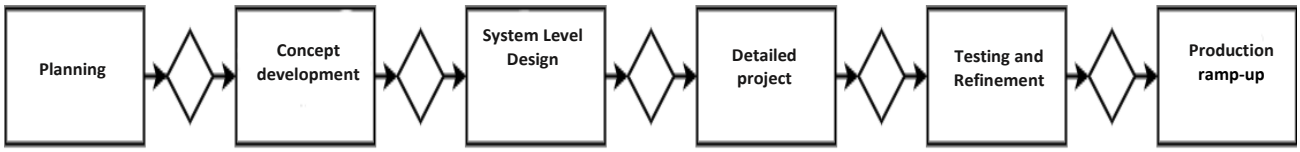

FIGURE 2 – Generic model of the product development process by Ulrich and Eppinger (2008)

Source: Adapted from Ulrich and Eppinger (2008).

This process begins with the identification of opportunities, guided by the organizational strategy, generating the mission statement; and ends with the product being manufactured, using the intended production system, and gradually being released to the market.

In the process of developing the concept, the needs of users/customers are identified. At this stage, the objective is to understand such needs and communicate them effectively to the development team. For Ulrich and Eppinger (2008), identifying customer needs is a five-step process:

1. To gather initial information provided by customers;
2. To interpret initial information in terms of customer needs;
3. To create a hierarchy of primary, secondary, and, if necessary, tertiary needs;
4. To establish the relevance of needs;
5. To reflect on the results and the process.

The first step, data collection, involves contacting customers and experiencing the product's usage environment. Three methods are commonly used in this step:

1. Interview: one or more development team members discuss needs with a single customer;
2. Focus group: a moderator facilitates a two-hour discussion with a group of eight to twelve customers;
3. Watching the product in use: Watching customers use an existing product, or perform a task that a new product is intended for, can reveal important details about their needs.

Ulrich and Eppinger (2008), in their study, address each of these five steps and use, as an example, the production of a cordless electric screwdriver, a relatively well-developed product category. However, according to the authors, a structured process can be useful to satisfy customer needs in both revolutionary products and incremental product improvements. The authors also state that the specifications for the product that will be developed will depend on what is technically and economically viable, what competitors offer in the market, and customer needs.

The Stage-Gate model

The Stage-Gate model (COOPER, 2001) is a process to manage product development, organized in a structured and scripted way. In this way, attention is focused on the creation of evaluation, monitoring, and evolution structures, being a systematic process that begins with the verification of customer needs, the ideation phase of a new product or service, and ends with its launch, as shown in Figure 3.

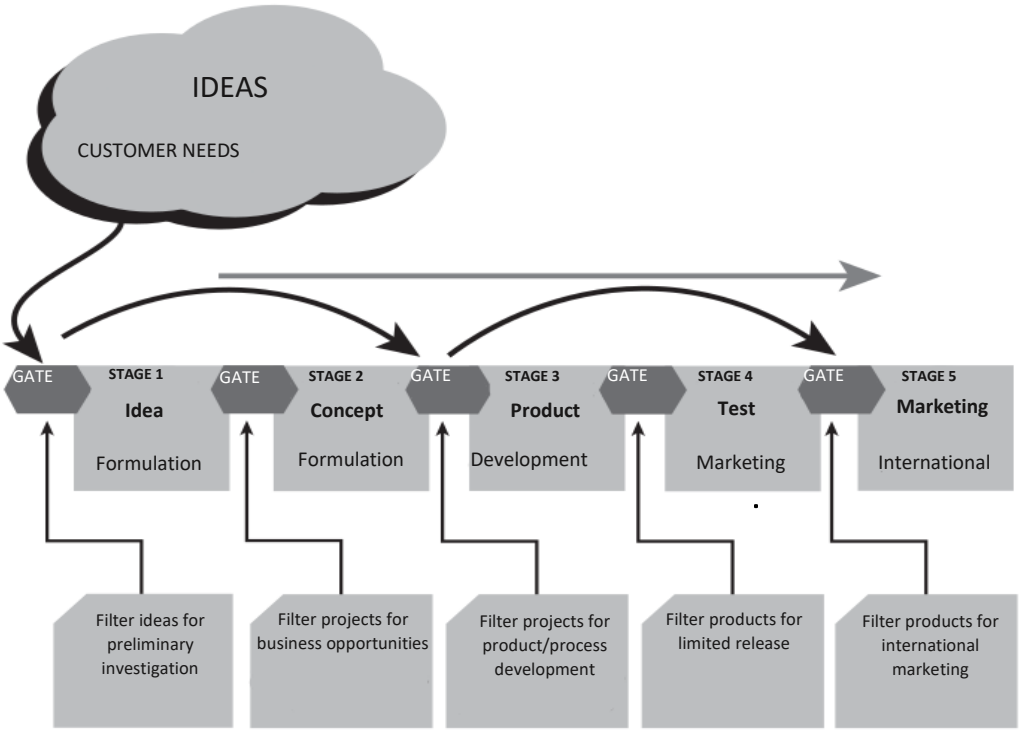

FIGURE 3 - Stage-Gate Model for the Product Development Process

Source: Tidd and Bessant (2015).

The author divides the product development process into stages, at each stage there is a gate, or decision point, as quality control for the project to advance to the next stage.

In Cooper's (2001) model, customers appear in several phases, such as the idea generation phase, a preliminary investigation stage in which companies seek, through surveys and interviews with customers, market information. In the product development stage, customers can assist with prototyping tests, being a quick and important source to know their reactions and seek feedback. In the testing and validation stage, the product is used with customers in real situations.

The Lean approach

The Lean approach has great relevance, both in academia and in business, for the results it generated for the Toyota company. Initially, the Lean approach, called Lean Manufacturing, or lean production, was applied to eliminate waste in the production process. In this way, several researchers

were interested in studying and publishing their perceptions about this approach, aiming to expand the benefits of the product development process (PINHEIRO; TOLEDO, 2016).

The principles of the Lean approach in the product development process, according to the authors Morgan and Liker (2006), consist of creating more value with fewer resources and effort. From this perspective, Mascitelli (2004) presents five principles for lean product development:

Principle 1: To define value by identifying the customer's needs and problems and what must be done to solve the problem.

Principle 2: To identify the fastest flow that adds value to the production process, making it possible to deliver a low-cost, high-quality product.

Principle 3: To make the process flow by eliminating waste and redundant or unnecessary costs.

Principle 4: To listen to the customer frequently and interactively throughout the development process.

Principle 5: To reduce ongoing costs by adopting cost reduction methods and tools.

As can be seen, the first principle consists of understanding the concept of value for customers, forcing people to see the final product from the perspective of customers, who are truly responsible for the survival of a company. In this way, the Lean approach proposes to train professionals to produce better by eliminating waste, as a result of meeting customer needs.

Models of software development processes

In the area of software development, there are traditional processes, oriented to planning, and agile processes, oriented to the delivery of value from experiments. In traditional processes, which are a theoretical and practical basis for the most recent models, there is the waterfall model, the concept of iteration with the incremental delivery and spiral development models, and the Rational Unified Process (RUP) (SOMMERVILLE, 2007). Agile process models emerged after the publication of the Agile Manifesto, which was the result of a meeting with 17 leaders who worked against the flow of software industry standards (BECK et al., 2001). The Agile Manifesto represents four premises:

- Individuals and iterations are more important than processes and tools;
- Working software is more important than complete documentation;
- Customer collaboration is more important than contract negotiation;
- Adapting to change is more important than following the initial plan. (BECK et al., 2001).

The authors of this Manifesto were inspired by some of the already consolidated techniques of the Lean approach to product development, adapting them to the software. Lean Software Development, Extreme Programming (XP), and Scrum are examples of agile models in software development. Lean Software Development, according to Poppendieck (2007), is the adaptation of the principles of Toyota's product development system (Lean approach) for software development.

According to Sutherland and Schwaber (2007), Scrum was also inspired by the best practices of the Japanese industry, especially by the principles of the Lean approach and the knowledge management strategies created by Takeuchi and Nonaka (1986). Initially, the Scrum methodology, by Takeuchi and Nonaka (1986), was developed for the management of physical projects, such as automobiles and consumer products. In 1995, this agile model was formalized as a software development method. Because of this, it has an unusual appearance, works in any domain, being used by companies in all business domains. Scrum supports a creative approach to developing complex and innovative systems and is scalable to a large number of developers (SUTHERLAND; SCHWABER, 2007).

Extreme Programming (XP) engineering practices evolved with Scrum, and these two core agile development processes work well together. Scrum and XP are agile practices used around the world, and their creators are participants in the creation of the Agile Manifesto (SUTHERLAND; SCHWABER, 2007).

Agile methodologies, according to Bassi Filho (2008), highlight the importance of knowing how to relate to people, as well as having the customer participate and contribute to seek a better solution, deliver a quality product and be able to adapt to changes.

METHODOLOGY

The research carried out in this study can be classified as qualitative, since it has no statistical focus and its result is based on a linguistic-semiotic investigation. For this, as stated by Creswell and Creswell (2017), fieldwork and contact with the studied environment are necessary to collect the information, such as, for example, through an analysis of the interviewee's discourse and his/her posture in the questions presented by the researcher. According to Prodanov and De Freitas (2013), qualitative research is exploratory, as it involves a survey of bibliography and the collection of primary data, as is the case of this study.

Initially, the theoretical foundation was carried out, obtained from studies related to the management of innovation, seeking the best practices of the process of developing new products and detailing the importance of the participation of customers/users. Then, interviews with professors (users) were organized to understand the needs, possibilities, and restrictions of the target tool of this study.

For the collection of primary data, we chose to work with convenience sampling. After selecting the users, the teachers, we carried out a semi-structured interview to clarify the following question: "what should an educational tool for teaching plagiarism have to promote learning?". The invitation to participate in the research was made by electronic mail (e-mail). The interviews were individual, with an average duration of 30 minutes, and took place according to the availability of the teacher.

For the analysis of the collected data, we chose the technique of content analysis. Content analysis is understood as "a set of communication analysis techniques aimed at obtaining, through systematic and objective procedures for describing the content of messages, indicators (quantitative or not) that allow the inference of knowledge regarding the conditions of production/reception of these messages" (BARDIN, 2016). According to Bardin (2016, p. 125), this type of analysis should be organized into three stages: "1) pre-analysis; 2) exploration of the material; 3) treatment of results, inference and interpretation".

The first stage involves choosing the document, and in our case, we chose phrases from the transcripts of the interviews. Subsequently, the following statement was defined as a hypothesis: "teaching about plagiarism is not often worked with higher education students". Then, the formulation of the general objective was carried out, which consists of understanding how the teacher works with the concepts of plagiarism and ethics, in the classroom, and the contents that must be worked with the students, verifying the needs of the teachers to develop the proposed educational tool. In the second stage, coding operations were carried out, which, in this case, it was the qualitative analysis and the choice of thematic categories. The categorization process systematizes the interview records into categories to better understand the data diversity. Finally, in the third stage, the inference is carried out, in this phase of the work "the content analysis provides supplementary information to the critical reader of a message" (BARDIN, 2016), and the reader will be able to analyze both the message and its respective sender and receiver.

In the next section, we show the results of this analysis.

PRESENTATION AND DISCUSSION OF RESULTS

The results shown below are part of an exploratory investigation. However, as it is qualitative research, the results are not conclusive and cannot be used to make generalizations. From the interviews, evidence of good practices was found and discussed to be incorporated into an interactive educational software for teaching concepts related to academic plagiarism.

Interviewed participants

All sixteen volunteer respondents work at the same institution, are professors in higher education, have postgraduate degrees in different areas of training, and have at least 3 years of experience as professors. To ensure the confidentiality of the interviewees' data, each of them was classified by a

number between 1 and 16, following the criterion of time of teaching experience. Thus, interviewee 1 has more experience than the others. Table 1 presents the profile of the interviewees regarding their last academic training, the date of the last training, and the time of experience as a teacher.

TABLE 1 - Profile of respondents

interviewee	Last formation	Date of last training	Time of teaching experience
1	Ph.D. in Operations Research	1981	37 years
2	Ph.D. in Computing	2002	26 years
3	Ph.D. in Education	2009	22 years
4	Ph.D. in Applied Computing	2002	21 years
5	Ph.D. of Science	2006	19 years
6	Ph.D. in Computer Science	2006	18 years
7	Ph.D. in Applied Mathematics	2005	16 years
8	Ph.D. in Physics	1998	16 years
9	Ph.D. in Computer Science	2006	15 years
10	Ph.D. in Electrical Engineering	2009	13 years
11	Ph.D. in Social Anthropology	2008	11 years
12	Ph.D. in Mechanical Engineering	2010	10 years
13	Ph.D. in Agrochemistry	2008	9 years
14	Ph.D. in Chemical Engineering	2011	7 years
15	Ph.D. in Chemistry	2013	4 years
16	Ph.D. in Electronic Engineering	2014	3 years

Source: Prepared by the authors.

Analysis of the interviews

For content analysis, responses were separated into categories: content; pedagogical approach; Customer suggestions and needs (teachers); verification of competitors; skills; and target audience. These categories were created after reading the excerpts from the transcripts of the interviews, considering the thematic aspects and objectives of the study. Thus, considering a qualitative data analysis, built from the objectives outlined in the semi-structured script and the clipping of the speeches of the interviews, the following data analysis is presented.

Content

Regarding the students' awareness of the problem of plagiarism and ethics, all the interviewees mentioned the importance of these topics, however, seven of the sixteen interviewees include, in their subjects, a class to talk about this problem, providing content on the topic. A professor talks about it when he teaches Undergraduate Theses or Methodology classes. Another professor is not teaching undergraduate classes, only graduates, but mentioned that, at the time he worked more as an undergraduate professor, no concern exists today about plagiarism and it was more difficult to detect. Three professors mentioned that they do not present this topic very often. Two others reported that

they do not dedicate a specific time to discuss the subject in the classroom, they work, however, implicitly, with practices that make plagiarism difficult among students.

Two professors consider that, in higher education, students should already be aware of plagiarism, with the basic principles of this topic clear. In this way, they do not reserve a class or a specific time for the development of this topic, they only make occasional comments, informing that unethical behavior will be punished.

In this category of contents, we sought to identify those most relevant for teaching about plagiarism to be treated by the educational tool. Some professors mentioned that they consider it important to explain what plagiarism is, its impact, and the legislation that deals with the subject. They mentioned the importance of giving examples, showing cases of plagiarism, and explaining the forms of citation and references, according to ABNT standards. A computer teacher considers it important to discuss the legislation related to software development, showing the importance of respecting the type of license for educational software. Another professor mentioned the importance of showing students that plagiarism does not pay, emphasizing the value of networking at the university, which will reflect on their professional life. He further stressed that they should be concerned about showing ethical behavior among their peers, as unethical behavior at the university could hamper their professional careers. Another teacher mentioned that he does not understand why students commit plagiarism and emphasized that it would be enough to insert the reference. He also considers it interesting to have a kind of code of honor, explaining the appropriate and inappropriate postures. One teacher commented on the importance of dealing with self-plagiarism, as the student thinks that if he/she wrote the text, then he/she can reuse it anywhere, without citing it. He also said that he considers it important to explain what a bibliographic search is like and emphasized that students need to know how to do it, to do it right.

One of the interviewees mentioned that he considers that most students commit plagiarism because they are unaware of the problem, as well as the citation and reference rules. Two professors found it important to tell stories of people who were involved in cases of plagiarism. Another considers it essential to address the issue of ethical responsibility and values in research and recalled that, in his time as an undergraduate student, at the university where he studied, this content existed and, in addition, there were punishments for those who disrespected the rules. One of the professors does not consider it necessary to teach ethics to talk about plagiarism. He mentioned that ethics is a subject for philosophy, even though talking about plagiarism is in the realm of ethics. He considers that something objective and succinct could give a better result. Another professor also mentioned something similar, saying that morals and ethics are subjects discussed for centuries and that, until today, it has not been possible to conclude them. He suggests not getting into this theoretical discussion, going more along the lines of examples, emphasizing that this approach has greater didactic potential.

The fact that less than half of the professors interviewed frequently address the issue of plagiarism in the classroom is corroborated by the research by Krokoscz (2011), who shows that the issue is rarely addressed in universities in Brazil. In the same study by Krokoscz (2011), the main strategies addressed in plagiarism were verified, in universities in Brazil and the rest of the world. Based on this survey, the author recommends some actions against this attitude. One of them is the adoption of pedagogical strategies with content on academic writing and plagiarism, in a specific discipline, to help students not commit plagiarism.

Pedagogical approach

For respondents to answer questions related to the pedagogical approach, this issue was raised more generically, without focusing on a particular teaching approach to plagiarism, since not all respondents address it. Of the strategies or methods used in the classroom, the use of content exposure was mentioned (slide presentation, with figures and graphs; blackboard; and videos), with a group or individual work, in the form of fieldwork, development prototypes, seminars or projects. One of the professors reported that, currently, he has been working with students on what he usually calls a "development blog", in which they are divided into groups. In it, the students propose a theme they want to work on, and each group has to adapt the work to their theme, inserting all the activities proposed by

the professor and adapting to the group's theme on the blog. Another professor reported that he currently uses active methodologies, with very short exposure time, making material available to students before class. During the class, he conducts activities to discuss or analyze some cases, in search of solutions to a given problem.

One of the professors reported that he gave up asking for written works for undergraduate students, as all the works he received contained texts copied from the internet. Thus, he prefers to give exercises to be handed in at the end of the class. Another computer professor mentioned that he does not care to verify that the student has copied the answers to the exercises, as he considers that if he does not do his work, as a consequence, he will not do well on the test. One of the professors mentioned that he encourages students to discuss the exercises with other colleagues, but always avoids sharing material, and guides them that the answers are individual. Another professor complimented saying that the interaction helps in the assimilation of the content and the teaching-learning process.

Next, the approaches and techniques used specifically in teaching the concepts of plagiarism are detailed, in teachers who frequently and explicitly carry out awareness-raising work at the beginning of each semester. One of them provides, in the virtual learning environment (VLE), a video and an article (text) that talk about plagiarism. He emphasized that most students are more interested in video and use it as a way of acquiring information. Another professor makes a presentation including the Federal Law, explaining that plagiarism is a crime, giving examples of plagiarized texts, and then explaining how to transform a text with plagiarism into a text without plagiarism, showing how to quote and reference. In addition, he mentioned that the students work in groups to deliver the reports of the practical classes and that he informs them that he will submit such reports to a plagiarism detection tool. Therefore, for reports delivered with plagiarized text, the grade assigned will be zero. Even though he makes it clear that he will use a plagiarism detector, he still comes across students plagiarizing because, it seems, they believe they will not be caught.

A professor reported that he teaches a course for the first year of graduation and, in the class in which he deals with the structure of the scientific text, he teaches how to quote, and mentions that the student cannot copy the text from the internet or the book without quoting and warns that plagiarism is a crime. Another said that every time he passes the guidelines on how the subject will work, he explains what plagiarism and copying are, that they are crimes, showing some cases of plagiarism and articles that were taken out of circulation because of this, and describes that it is not right, that they should not plagiarize and that they will not tolerate the such practice, making it clear that, if he identifies plagiarism, the student will be punished. Another professor mentioned that he raises awareness among students by telling real stories of teachers and students who have engaged in plagiarism. He also talks about the importance of referencing the text and explains how to do it. He also tells students that they must read, understand, write in their words and cite the source of the text they copied.

One of the interviewees stated that the subjects he teaches have more practical than written work and that, in this way, he works more on the ethical issue, emphasizing that ethics is addressed in all its subjects and emphasizing that it is a lack of ethics, in addition, to be a crime, sign the attendance list for the other. He also mentioned that the students find this fact normal, not considering the classroom as a job, since, in the workplace, they would have a different attitude, they would think better about their attitude and its consequences. Finally, he said that he believes that this type of attitude comes from the base, as well as he believes that students consider it smart. Another professor also addresses the issue in the field of ethics, and character, mentioning the attitude that students should have in the job market and emphasizing that, wherever they work, they need to adopt an ethical posture, without harming others.

Some professors reported that they do not spend any time on this topic. However, they work implicitly. One of them proposes that students work in groups and choose a topic, considering that this already reduces copying between them. Even so, he mentions that there are groups that choose very similar themes, but, as they are practical works, plagiarism becomes difficult. Another technique used and applied to written works is to demand from students many figures, making plagiarism difficult. This interviewee also considers that, in sophisticated works, it is more difficult to commit plagiarism. However, he has already come across the plagiarism of figures. Another teacher points out that, at the current moment, with the New Coronavirus (Covid-19) pandemic, this matter has become more

complicated, as activities are carried out at home, without on-site supervision, making it difficult to control the issue of access and copying of texts. However, he considers that plagiarism is a recurring problem and also mentions that it is necessary to invest a little more in raising students' awareness of how important the ethical issue is in their academic activities, emphasizing to students that this is a professional issue, leading to the reflection of how far they will take the lack of ethics in their research, academic work, professional environment, and personal life. He indicated that he tries to minimize the problem by carrying out faster activities, to the point of not giving the student much time to do research. He also mentioned that another strategy he uses is to customize the exercises, however, he says that this makes corrections difficult, but it is a way to mitigate plagiarism.

These same interviewees, who apply to teach approaches to plagiarism, mentioned that they have already received plagiarized works and that the strategy adopted, in these cases, was to dialogue with the student and apply some type of punishment to those involved, such as, for example, grade reduction, or zero grade.

Regarding the process of evaluating whether the student acquired the knowledge, the teachers mentioned the following actions as a form of evaluation: working with the students in the form of a project, aiming at the delivery of a final work; accompanying students during classes, evaluating their participation in the classroom; seminar presentations; and tests or exams in the classroom. Four professors indicated the adoption of tests or exams. One of them said that he applies tests with consultation, in case students do not deliver the requested work, as he considers it important for students to know how to look for information and not "memorize" what he said in the classroom. He emphasized saying that the content changes very quickly and that he values how the person will seek knowledge, because, when they leave college, they will not have a teacher to help, being forced to seek knowledge alone.

Some interviewees mentioned that they do not usually give evidence. One of them said that it assesses student participation, self-reflection, and activities such as seminars. He reported that such activities allow monitoring of the student's development. One of the professors, who mentioned the seminars as a way of evaluation, said that, currently, due to the pandemic of the New Coronavirus, this evaluation method had to be suspended. Another also cited the pandemic, reporting that the weights between exams and assignments will have to change. He said that the biggest burden will be the work, which will propose a programming challenge, and that he will inform beforehand that he will check if plagiarism has occurred. Another professor reported that he evaluates work in pairs since students do not like to work with larger groups. He said that even when they are forced to work together, you can see that each of them wrote a part and that they did not get together to do the work. One of the professors reported that, in fieldwork, in which students need to develop a prototype, he evaluates whether they copied, referenced, or used the idea of someone they found, most of the time, on the internet, or even if they added something to their work based on third party work.

Analyzing the content of the interviews selected in this category, most of the pedagogical approaches adopted by teachers demonstrate an alignment with the orientation proposed by Du Rocher (2020), which shows, in her research, that teachers should consider increasing the use of active learning methodologies as a possible means to reduce the plagiarism of their students. The author concludes that more ethical postures regarding plagiarism are reflections of increased student motivation to study when using active learning methodologies.

Even so, we observed that there is no specific type of evaluation on the teaching of topics related to plagiarism, and it is possible to verify that the teaching of the topic, when applied, is more focused on a traditional teaching structure, such as lectures, that reduces, for students, the opportunity to practice their knowledge at the moment they are evaluated, that is when they deliver their work. According to Moran, Massetto, and Behrens (2006), conventional classes based on the expository method are outdated and end up demotivating students. Lobo and Maia (2015) mention the importance of "learning by doing, learning to learn, interest, experience" in the teaching-learning process. In the study by Barry (2006), the importance of having students practice paraphrasing techniques is addressed, rather than just teaching them the definitions of plagiarism.

Customer suggestions and needs

In this category, we verified with the professors which activities could be included in the educational tool.

Two of them would like the tool to have a way for the student to analyze the originality of the text. Two other professors mentioned that it would be interesting for the tool to suggest some detection software so that the student has the opportunity to check his texts and compare them to others on the internet. A professor mentioned that he would like the tool to have an activity in which students, based on suggested texts, have to detect plagiarism. Another professor suggested that the tool provide activities such as "read a text and make a summary", but that it is possible to access tabs explaining what plagiarism is, the legislation on it, what a summary is and how to do it. In the same sense, three professors suggested that there be a practical activity, such as, for example, applying a text for the students to rewrite, checking if they know how to interpret, use their words, and, finally, cite. Another suggested presenting the student with excerpts of texts that were considered plagiarism, so that he could evaluate and judge, based on what he had learned on the subject, whether he would classify the text as plagiarism or not. A professor suggested that the tool should showcase plagiarism and its penalties and that this does not only happen in texts, stating that there is plagiarism of ideas, products, and patents. Also, he suggested creating a chatbot (virtual assistant), for the student to answer their questions about the proposed content. One respondent would like the tool to show examples of plagiarized texts. Another commented that he finds it very difficult to hold the student's attention and motivates him to respond to a type of activity on this subject. He believes that, to have good results, it is interesting to involve students with games, or that they have some gain (of concept or grade) using the tool.

Two professors reported that they consider it important to work with students in an interactive way, arousing their interest. One mentioned working with a kind of quiz (question and answer competition). Another suggested videos with subtitles, to help students who have a hearing impairment or who, for some reason, cannot use the sound loudly. He also suggested audio descriptions, to help those with vision problems, as well as only allowing the student to proceed to the next topic after answering a few questions.

As discussed in the theoretical reference, the participation of users in the process of developing new products is very important. In this way, the lack of survey or understanding of the needs of these users can lead to the failure of the product.

Therefore, a process focused on the search for innovation based on the involvement of customers/users is extremely important, especially if we consider that the software market has a wide range of opportunities, which allows companies to create solutions to meet needs and challenges not yet overcome by its customers/users.

Verification of competitors

Initially, to identify the use of information and communication technologies (ICTs) in the teaching-learning processes, respondents were asked about the educational tools they usually use or have already used in the classroom. Most teachers mentioned the use of support tools, such as VLEs: Moodle, Google Classroom, and Blackboard. One of them described Google Classroom as being very good, easy to use, fast, with good storage capacity and a user-friendly interface. Another considers that Moodle has more features than Google Classroom.

Peripheral tools such as Google Forms, Google Drive, Youtube, e-mail, and Whatsapp were mentioned, the last three used as communication tools. One of the professors reported that he currently tries to use the flipped classroom (previous availability of content and subsequent discussion in the classroom). To do this, he uses Google Classroom and tools that allow quick questions, such as Mentimeter. He also uses software to ideate with students. Another professor indicated the use of software to create mental maps with the students, to know what they thought of the class. He reports that he also uses a quiz, with some quick questions, to measure attention to the class.

Some interviewees referred to the use of specific tools for their subjects, such as programs used in digital circuit classes: simulators. For the computing area, the online Judge system was mentioned. One of the professors, who use the open source Judge system, pointed out a concern with the availability

of the service, as the system is hosted on the institution's infrastructure, which suffers from a lack of investment. In this way, the system is not available 24 hours a day, impairing student learning. Another professor mentioned the use of climatology sites, which are tools for climatology classes, such as, example, Ventusky. One mentioned that he does not use any tools, but listed some that are being used by other professors in the classroom, such as Lego, for mathematical models, and simulation software, name not mentioned. Another pointed out that he had already used, in elementary school, a software called Cabri, for teaching and building algebra concepts. One professor said that he uses, in his classes, a website that calculates the ecological footprint, in which the students answer some personal questions, and, in the end, it is possible to know the amount of renewable natural resources to maintain the lifestyle, making, of this action, a work of awareness for the students.

Regarding the use of specific educational tools for teaching about plagiarism, teachers reported that they have never used them and that they do not know of one for this purpose. Two of them mentioned the specific subjects on content found in some universities, and one cited the booklet of the *Fundação de Amparo à Pesquisa do Estado de São Paulo* (Fapesp) as being very good material, but with very long content. Nine professors mentioned that they only know plagiarism detection software and mentioned some such as Turnittin; SafeAssign; online plagiarism detectors and the Google search page itself, but not with a focus on teaching, but rather on identifying possible cases of plagiarism.

Therefore, as presented by Tidd and Bessant (2015), checking competitors and best practices contribute to the understanding of the market, in addition to being fundamental to comparing its characteristics and processes, becoming a great source of inspiration, as it is possible to identify approaches that are used in other contexts and bring them to the target tool of this study.

Skills

Regarding skills, after using the educational tool, professors reported that they expect students to acquire the following skills: identify what is plagiarism; not to practice plagiarism; learn to avoid plagiarism; writing texts and developing products ethically; be aware of differentiating what is plagiarism and what is an inspiration; to be able to construct an unpublished text; write a text without plagiarism; understand what is a copy and what is an original text; have basic knowledge and notion of what plagiarism is; recognize plagiarism and use citation and reference rules; acquire knowledge of the legislation relevant to the topic; to develop a critical analysis, a self-reflection on their posture and, consequently, a more ethical posture.

One of the professors mentioned that he expects students to acquire the same skills that they could acquire in face-to-face teaching, but considers that there will always be losses. He alludes that the main problem of online teaching is assessment and emphasizes saying that he has never taught a course entirely at a distance and is not sure if the assessment system can measure whether the student has acquired a certain skill.

Another professor mentioned that the fact that the student can know how to identify plagiarism does not mean that he will not commit it. He reported that having the ability is one thing, having the attitude is another, and highlights that students have, on a massive scale, the ability to identify what is plagiarism and that the key point is not the ability to identify, but the execution.

Thus, before building an educational tool, it is necessary to define the learning objectives (CAMPOS; CAMPOS; ROCHA, 1996). Checking and knowing which skills students are expected to acquire after using this tool helps teachers understand the learning objectives and develop a tool that will help the process of building and acquiring these skills by students.

Target Audience

According to the interviewees, more specifically fourteen professors, the proposed educational tool could be used, in addition to undergraduate students, by graduate students. One professor said that it is necessary to make adjustments to use it in graduate studies. One of them commented that postgraduate students are charged for publications, which are often international. He also mentioned that the editors of international journals are increasingly concerned with the problem of

plagiarism, and, for this reason, one of the first actions taken, when a text is submitted to a journal, is to check if the text has plagiarism. As a result, texts that contain similarities with previously published texts are then rejected.

Two professors mentioned that it is perceived, in postgraduate courses, that students who stray a little from the academic environment and come from the job market have less knowledge about plagiarism. Another said that it would be interesting to apply an educational approach from high school. In this way, students would reach graduation more aware of what plagiarism is. Two professors consider that the issue of plagiarism should be addressed at all levels of education. One of them reported that the fact that this topic is not discussed so much in higher education stems from pre-established knowledge and attitudes.

In the development of educational software, knowing the profile of the users of this tool will help how it can achieve the learning objectives. In this context, Júnior et al. (2020) mention that it is necessary to adapt the content to the target audience using videos, images, and exercises.

The derivation of requirements

With the interviews, followed by the content analysis, we grouped the subjects and similar themes addressed by the professors in the interviews. This grouping was intended to facilitate the specification of the requirements of the educational tool and the subsequent definition of learning objects (online tutorials, videos, animations, images, etc.), which must bring information that helps the construction of knowledge, being able to be reused or rearranged, according to Carneiro and Silveira (2014). For this grouping, the main phrases said by the interviewees were listed and we sought to identify, in these phrases, the main referenced contexts. With this, we could find the distinctions of this group regarding its application in the educational tool and the specification of the requirements for the development of this tool, as can be seen in Table 2.

TABLE 2 – Excerpts from the interviews with customer needs grouped by subject and the specification of the initial requirements for the development of the educational tool

Grouping	Statement of needs	Specification of requirements
Content online tutorial	*It is important to show students that plagiarism does not pay, emphasizing the importance of networking at the university, which will reflect on professional life, emphasizing that they should be concerned about showing ethical behavior among their colleagues, as unethical behavior at the university could hinder their professional career.*	The system must show content about: – Attitudes and importance of academic writing; – Academic misconduct – plagiarism; – Types of academic plagiarism; – How to avoid plagiarism: direct citation, indirect citation, ABNT citation, and reference norms and paraphrasing; – Legislation – implications; – Cases of plagiarism; – Suggestions of plagiarism detection tools; – Legislation for software development; – How to find reliable bibliographic sources; – Good practices in academic research;
	Explanation of what is plagiarism and legislation about it.	
	Discuss citation and reference rules.	
	Informing the legislation, giving examples of plagiarized texts, and then showing how to build the text without plagiarism and make citations and references.	
	I think it's important to deal with self-plagiarism because the student thinks that, if he wrote it, he can reuse it anywhere indiscriminately, without citing.	
	Definition of plagiarism, penalties, show examples of people who have committed plagiarism.	
	Showing real cases of plagiarism.	
	Definition of plagiarism, penalties, show examples of people who have committed plagiarism.	
	Explaining what plagiarism is and ways of citing and referencing ABNT standards	
	Explaining what a bibliographic search is like.	

Grouping	Statement of needs	Specification of requirements
	Citing legislation related to software development.	– Code of honor – institutional document.
	I don't think you need to teach ethics to talk about plagiarism. Even because, the ethical theme is much broader. I think something objective and succinct will give a good result.	
	Having a kind of code of honor, an institutional document, fixed in a place where students will see it.	
	Suggesting plagiarism detection tools, for students to check their texts.	
Online tutorial on interactivity	*Using videos and interaction, where the student can proceed to the next phase if they answer a question. The content is only released after he answers this question. Using videos with subtitles and audio descriptions, for students with special needs.*	The system must provide the student with learning objects with animated videos, interactive videos, and games. Videos must have subtitles.
	It would be interesting to involve students with games or for the student to gain some grade or concept using the tool.	
	Students prefer watching videos to reading texts.	
	A kind of quiz for students, an interactive tool that sparks students' interest.	
Use of questionnaire	*Maybe work with games.*	The system should have a questionnaire with multiple choice questions and open questions. The system should give feedback with corrections and explanations. Open questions: the system must correct using a similarity detection mechanism between the texts (original and student version).
	A kind of quiz for students, an interactive tool that sparks students' interest.	
	Practical activities suggest a text and ask them to write it down.	
	Activities for students to identify if it is plagiarism. The student evaluating and judging, based on what he has learned about plagiarism, would classify a certain text as plagiarism.	
	An exercise in knowing how to read and interpret, using their words for that interpretation.	
	Providing "read the text and make a summary" activities.	
	Something practical, where they could take a text and see what they are going to rewrite about this text and, in the end, the system will tell if what they wrote is plagiarism or not.	
	I wish there was an activity in which, from suggested texts, students have to detect plagiarism.	
Similarity detection for teaching purposes	*I would like the student to be able to check the originality index of his text.*	The system should offer the possibility for the student to check the similarity of his text with others on the internet.
Virtual Assistant	*Creating a Chatbot (virtual assistant), for the student to answer their questions about the proposed content.*	The system must offer the student a virtual assistant capable of responding to the pre-defined contexts of the proposed topic.

Source: Prepared by the authors.

Requirements specification is the basis of software development projects. Although there are several methodologies for the development of new products, some activities are common to all of them, as is the case of requirements definition. Therefore, this definition is an important phase for both traditional software development processes and agile methods (SOMMERVILLE, 2007).

The derivation of requirements influences the quality of the system and the satisfaction of the users. In this way, it is important to include users in this process, helping to define the desired

characteristics, and enabling to reduce of errors in the software development stage, which can happen with the lack of a derivation of ineffective requirements.

This study, in addition to raising the needs and suggestions of teachers, was also important for the definition of the teaching methodology and for the identification of the learning objectives, which must be inserted in the target tool of this study. Based on the teachers' speeches, in the pedagogical approach, a vision of how they work in the classroom was obtained. As an example, we found that most of them use active learning, in which the student is the center of the learning process, that is, "the student is the protagonist of the process of acquiring knowledge and developing skills, abilities and attitudes" (YANAZE, 2015).

To prioritize the development of competencies and skills, based on what Nakao, Borges, Souza, and Grimoni (2012) suggest, the learning objects to be defined from the derivation of requirements can be organized according to 3 premises: (i) attitudes – choosing to do –, exposing the ethical issue and the reason why the student should take the attitude of not plagiarizing; (ii) knowledge, which is the definition of plagiarism, with its types and examples; (iii) skills – know-how –, in which students will be able to put into practice what they have learned through questionnaires, training in paraphrasing and source citation, moving towards higher levels of learning retention.

Given the analyzes carried out with the professors in their target audience, initially, the educational tool must assist undergraduate students, but its project needs to consider the malleability characteristic to adapt the system to suit different levels of education.

FINAL CONSIDERATIONS

This work aimed to share the experience and the process of deriving the specification requirements of the proposed educational tool, raising relevant information about the need and importance of user involvement in the process of developing new products. To this end, a bibliographic survey was carried out, interviews with professors from a higher education institution, and, later, the content analysis of the interviews.

With the bibliographic survey, we verified the best practices of the new product development process. Studying product development models is important to develop a product at a lower cost, increase its quality and reliability, and meet the needs of customers/users as much as possible. However, although there are several of these models, it is necessary to adapt them to each project situation.

In the initial stage, this study involved only one of the educational actors, the teachers/professors, who are at the forefront of the teaching process and are key pieces for the beginning of the construction of an educational tool. In this way, we sought to identify, with the interviews, the most relevant content in teaching about plagiarism, to be treated by the proposed educational tool, in addition to verifying the pedagogical approaches, that is, the didactic strategies used by these actors to help the teaching-learning processes. Even with interviewees experienced in teaching, not all of them often apply some approaches to teaching the topic of plagiarism in the classroom. Thus, we also verified that the professors are unaware of the tools aimed at helping the teaching-learning process on the topic. In addition, the interviews were fundamental sources in generating insights and in surveying the needs and suggestions of professors, given the various perspectives pointed out by these potential users of the system.

After the construction of the prototype of the educational tool proposed here, we intended to apply real tests and carry out a new study to test this software, submitting questionnaires to students and professors. The aim will be to obtain quick feedback on the use of this tool, mainly collecting data to identify the needs and functionalities desired by the students, one of the groups of end users of this tool. According to Ulrich and Eppinger (2008), a good approach is to collect data from all groups of end users of the product, in the case of this study, teachers, and students. Ulrich and Eppinger (2008) also suggest maintaining a relationship channel with the users interviewed to assess the relative importance of the needs that were identified.

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AUTHOR´S CONTRIBUTIONS

Author 1 – Project coordinator, data collection, active participation in data analysis, and text writing.
Author 2 – Definition and design of the methodology for conducting the work, data analysis, and review of the final writing.
Author 3 - Validation of collected data, visualization of results, data analysis, and review of the final writing.

DECLARATION OF CONFLICT OF INTEREST

The authors declare that there is no conflict of interest with this article.