

# Framework Proposal for Management of Knowledge and Technology Transfer in Brazilian Academic Internships

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**Abstract:** This article has the purpose of developing a framework for management of knowledge and technology transfer in Brazilian academic internships, with a Knowledge Management approach. The methodological procedures employed are classified as qualitative, bibliographical, documentary, and a survey, having academic internships in Brazil as the object of study. The framework proposed is an advantage in internship management, systematizing information, knowledge, and technology, in addition to increasing the potential of internship activities. The framework for management of knowledge and technology transfer in Brazilian academic internships offers its users not only a service of knowledge management, but also a Knowledge Management System with resources of Communication and Information Technology for the construction of a learning platform, in which coordinators, professors, supervisors, and student-interns would be able to manage the internship, its activities, and the online learning environment. In other words, it is an environment designed for the development of academic knowledge in professional capacities.

**Keywords:** Brazilian Academic Internship; Knowledge and Technology Transfer; Management of Knowledge and Technology Transfer.

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## 1. Introduction

With the development and widespread use of online technologies, web-based learning is increasingly more well-received by people (PENG; JIANG; ZHANG, 2013). The internet allows for the utilization of knowledge portals, an interface that facilitates interaction between users. Portals supporting Knowledge Management (KM) were designed to facilitate the transfer, storage, retrieval, creation, integration, and application of knowledge and technology.

The purpose of knowledge portals is the interaction of collaborators, including the interns among them. Internships are mechanisms of interaction between the educational institution (EI) and the organization, encompassing several forms of relationship. Among them is the Academic Internship, which is a supervised educational act developed in the work environment that aims to prepare the student for productive work. The internship is part of the student's approved coursework and of the degree's pedagogical project (art. 1<sup>st</sup> and its § 1<sup>st</sup> of Law 11.788/2008).

This context pointed to the need of pondering about the management model of Brazilian internships, which currently present a low level of KM, with the knowledge and technology acquired throughout being neglected and its results archived. The same context leads to knowledge and technology transfer (KTT), science-based knowledge and technology, and potential of market applicability. The possibility of KTT demands communication and information technology (CIT), that is, employing computers to obtain, evaluate, store, produce, present, and exchange information, in addition to communicating and participating in cooperation networks over the internet (TISSOT, 2004). The shift from a product-based to a knowledge-based economy has resulted in an increasing demand for organizations to implement knowledge management systems (KMS) at an accelerating pace (LAI; WANG; CHOU, 2009).

Knowledge Management Systems (KMS) are tools to create, select, store, and spread knowledge. In addition, they can greatly increase the creation, storage, and sharing of knowledge, and even enhance the efficiency of knowledge re-creation (SHIH et al., 2017). KMS are able to absorb explicit and tacit knowledge systematically (CHU, 2017).

Starting from the premise that the actions of internship management in Brazilian EIs are only directed toward the selection process, intern admission, and document management; and that the internship management systems do not conduct Knowledge and Technology Transfer with a KM approach, the problem is: How to transfer knowledge and technology in the interaction between Educational Institution and organization through the mechanism of Brazilian Academic Internships?

In view of all the aforementioned aspects and especially the importance of transforming the individual knowledge arising from internship activities into collective knowledge, this article has the purpose of developing a framework of KTT for Brazilian academic internships with a KM approach.

This research is part of a doctorate thesis, based on the originality criterion, and thus implies in presenting new perspectives in the approach to the research problem. The framework reformulates the Internship Management System (IMS), which becomes able to extract, memorize, share, and re-utilize knowledge and technology through a structured, systematized, and formal environment with the purpose of transforming individual knowledge into collective knowledge. Therefore, the contribution is the core condition for this research.

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## 2. methodological procedures

This research is classified as basic, with the objective of generating knowledge about academic internships in Brazil, knowledge and technology transfer, and knowledge management systems for the creation of the framework available for application in Brazilian EIs (GIL, 1999; OLIVEIRA, 2013). It employs a qualitative approach to the problem (MARCONI; LAKATOS, 2010) and it is descriptive in terms of objective (GIL, 2008; OLIVEIRA, 2013). The technical procedures (GIL, 2008) employed included a bibliographical research, a documentary research, and a survey.

The bibliographical research was elaborated from previously published materials, mainly books, theses, dissertations, and articles from journals available online. The documentary research was elaborated from materials that did not receive analytic treatment, such as Law no. 11.788, of September 25 2008, Internship Regulations, and Reports. The survey involved the direct investigation into Higher Education Institutions about Brazilian academic internships and their processes.

The research is classified according to the definitions and concepts presented by the authors Oliveira (2013), Gil (2008), and Marconi; Lakatos (2010). The scientific investigation approached and analyzed the BRAZILIAN ACADEMIC INTERNSHIP, this research's object of study.

The *Methodi Ordinatio* analysis was conducted (Pagani; Kovaleski; Resende, 2015), which employs the *InOrdinatio* equation to rate articles in order to select them according to their scientific relevance, taking into account the main factors to be considered in a scientific article: the impact factor (*Journal Citation Reports*® (JCR)) of the journal in which the article was published, the number of citations on *Google Scholar*®, and publication year. The rating task was carried out before the systematic analysis so that the article's importance was recognized in the initial stages of the process. The search was conducted in three international databases (*Web of Science*, *Scopus*, and *Google Scholar*®) and *Excel*® was the tool employed to classify the articles. The results indicated that the methodology was efficient

to arrange the most relevant works. The search was also conducted in databases of theses and dissertations, revealing the originality and relevance of the research.

The *Methodi Ordinatio* Analysis allowed for the construction of the problem and the objectives concerning Brazilian academic internships, management of knowledge and technology transfer, and knowledge management systems. The bibliographical portfolio revealed the importance of academic internships for professional experiences and how theory influences practice, allowing to establish metrics and systematize the viability for creating, organizing, formalizing, sharing, applying, and refining individual knowledge into collective knowledge, able of being reapplied by different users.

## 3. Management model for knowledge and technology transfer in Brazilian academic internships

Innovative educational technologies ensure the development of intellectual and professional competence, the wish and ability to create new knowledge, and the capability of solving tasks in a higher level of complexity (DUBININA; BERESTNEVA; SVIRIDOV, 2015). The academic internship is important for the professional life, seeing that it enables the student to plan for their professional career and highlights the importance of theory and how it influences practice.

The management model for knowledge and technology transfer (MKTT) in Brazilian academic internships approaches the organizational environment and knowledge management systems (KMS). Seeing that the research focuses on Brazilian academic internships, it contemplates the relevant elements in the context of internships and intern activities.

The Organizational Environment identified and analyzed the organizational context in which academic internships are inserted in Brazil in order to ascertain the viability of the knowledge actions intended. The KMS aims to act as a repository and enhance the access to knowledge. To meet this objective, the key questions of KM were utilized, namely: With whom to share? What to share? How to share? How do the CIT contribute? How to make KM feasible?

Chart 1 – Key questions of KM

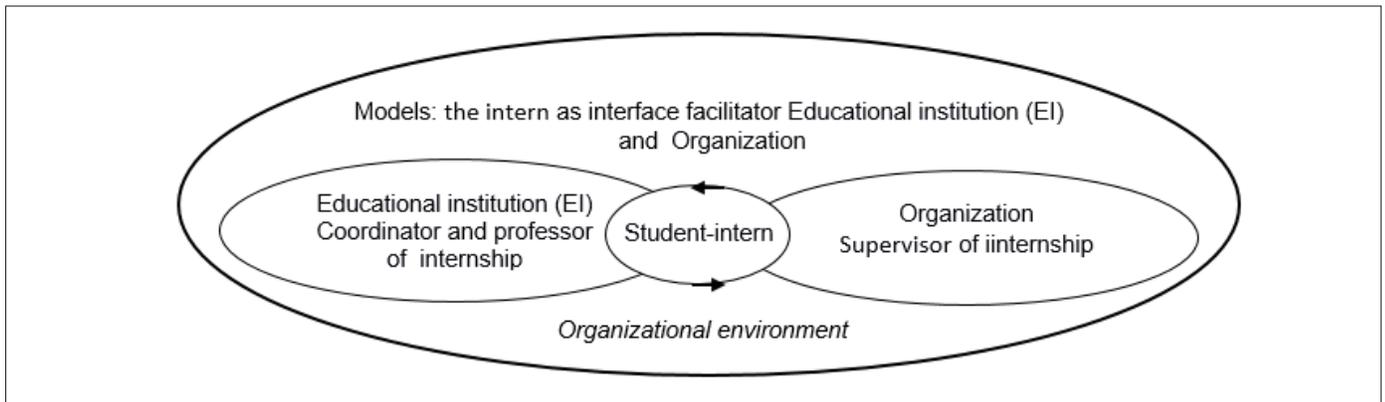
Key questions of KM				
With whom to share	What to share	How to share?	How do the CIT contribute?	How to make KM feasible?
Internal and external user.	Contents, KM practices, supplies, demands, etc.	Authorized and authenticated user.	Layer of data access.	Knowledge portal.

Source: the author

Firstly, the organizational environment is discussed in Figure 1 – Organizational Environment. The analysis concerns the models of

academic internships in Brazilian educational institutions, in light of Brazilian legislation.

Figure 1 – Organizational environment



Source: Adapted from Francisco (2003)

The analysis employed the Organizational Environment, a part of the *CommonKads* methodology that identifies and examines the organizational context in which the framework is inserted, especially its main characteristics, in order to reveal problems and opportunities to the knowledge systems and to establish the viability of the knowledge actions intended.

### 3.1 Organizational Environment

The analysis allows to identify problems and opportunities for the framework development. These items are shown in Chart 2 – Opportunities, which presents the view of the organizational environment.

Chart 2 – Opportunities

Organizational environment	
Opportunities	<p><b>Opportunities:</b></p> <ul style="list-style-type: none"> <li>- improving the actual monitoring by the professor at the educational institution and the supervisor at the organization;</li> <li>- proper treatment of the knowledge and technology generated throughout the internship;</li> <li>- large amount of reports generated and filed;</li> <li>- existence of different levels and types of knowledge and technology;</li> <li>- standardization of the communications between EI, organization, and integration agent;</li> <li>- definition of indices for the EI and global indices for the organization in which the intern acts, so as to manage knowledge over the entire organizational process involved;</li> <li>- providing a knowledge base about the internship realized in the organization;</li> <li>- improving the results in the activities developed throughout the internship;</li> <li>- possibility of learning and improvement;</li> <li>- aid for new interns;</li> <li>- virtual library of Course Conclusion Papers (TCC – <i>Trabalho de Conclusão de Curso</i>)</li> </ul> <p><b>Problems:</b></p> <ul style="list-style-type: none"> <li>- dependence of user collaboration and interaction;</li> <li>- lack of KM culture in the EIs</li> </ul>
Organizational Context	EI, organization, integration agent, and processes and activities in Brazilian academic internships
Solution	Portal of Management of Knowledge and Technology Transfer (PMKTT), presented as a repository for academic internships and an interaction interface for the intern, professor, supervisor, EI, organization, integration agent, and external users, enabling the extraction, memorization, sharing, and reuse of knowledge and technology by different users (actors involved in internship activities).

Source: Research data

The effectiveness of any educational practice is related to its capability of increasing the student's involvement and the fact that the student's available time should be considered a valuable resource for the educational institution. While the educational institution has a critical role in this process, due to its responsibility to offer opportunities for the students to get involved, the students also play an essential role in view of their responsibility to make use of the opportunities offered (ASTIN, 1984).

The models of academic internships in Brazil follow Brazilian legislation, and the EI provides departments and human resources for the administrative activities (documentation) related to the internship, as well as professors with the responsibilities of coordinating and guiding the process. These actors ensure that the legislation is met by the organization and the student-intern, while pointing out low or non-existent KM practices.

There are gaps in the management of Brazilian internships and in the Internship Management Systems, such as difficulties in the interaction between EI and organization, or lack thereof, to follow the internship activities performed by the student; lack of indices; lack of previous knowledge about the internship activities already performed by areas or organizations; and the fact that the management of Brazilian internships or the Internship Management Systems do not allow the sharing of knowledge and technologies arising from internship activities.

The aforementioned gaps shed light on barriers or difficulties that must be surpassed so that the knowledge and technology present in the routines and processes of interns within organizations can escape from only documents and reports and be shared and comprehended through KM practices towards the creation of ideas and innovations in organizations and EIs.

The MKTT presents itself as a relevant, necessary intervention for the growth of organizations and EIs in several areas, highlighting the impact of the CIT for the creation of an environment of learning and collaboration, that is, new approaches for the interaction activities between the EI and the organization through the internship, exceeding theory and practice.

Maier (2007) views the CIT as facilitating elements for the effective and efficient implementation of KM, and KM instruments are developed in view of a specific goal, characterized by the treatment of contextualized information with the purpose of intervention and independence of the knowledge domain.

When a KM instrument employs CIT, it supports the Knowledge Management Systems (KMS) (MAIER, 2007), and when a KMS accesses and handles a representation of knowledge, that system may make use of Artificial Intelligence technologies (NISSEN, 2005; MAIER, 2007; QUINN, 20). Adequate repositories are made necessary for storing the data, information, and knowledge being transferred, from external and internal sources of the organization and EI, given that the CIT structure allows for the appropriate interaction between users. The

CIT, regarded as complementary mechanisms and sociocultural and organizational factors, determine the success or failure of KM (VON KROGH, 2002).

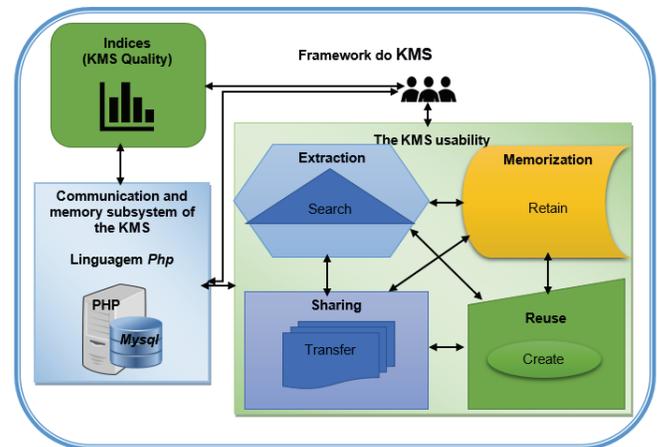
The opportunity for the intern to develop professional and intellectual competences, solve tasks of a higher complexity level, and create new knowledge may be observed in the framework for management of knowledge and technology transfer in Brazilian academic internships.

### 3.2 Framework for management of knowledge and technology transfer (MKTT) in Brazilian Academic Internships

The framework for MKTT in internship activities has a KM approach and does not contemplate the processes and activities developed in other departments of the EI and the organization. This research is a first KM approach for a KMS in Brazilian academic internships. The main constructs in the framework structure are the application of KM theories; the implementation of a systemic MKTT process in a continuous and evolving manner; the utilization of PHP and MySQL in the structure, allowing for adaptations to Brazilian academic internships.

The proposed framework employs the CIT (layer of database access), the usability and indices of KMS (layer of services), and is centered on the user, as shown in Figure 2 – Framework proposal for MKTT in the activities of Brazilian academic internships.

Figure 2 – Framework proposal for MKTT in the activities of Brazilian academic internships



Source: the author

Tian et al. (2009) suggest thinking about a creative environment in academia, employing customization strategies under the guidelines of a systemic mindset. In order to construct a culture of knowledge sharing, the environment must facilitate the communication and debate among users.

The framework is composed of users and indices, which represent different functions in the internship management system, the KMS usability, and the communication and memory subsystem of the KMS, aiming to support the management of knowledge and technology transfer.

The elements and subsystems that compose the framework proposal are described as follows.

### Communication and memory subsystem of the knowledge management system (KMS)

The framework is, importantly, a repository for the routine activities specific to Brazilian academic internships, transforming data into information and information into knowledge. It is also responsible for storing and managing the knowledge and technologies created, in addition to coordinating the research, creation, and transfer of information between users and KM practices, constituting the organizational memory.

Memory makes use of a data management process that includes data storage. According to Freitas Júnior (2003), this subsystem provides reliable information to answer user queries, obtaining data for developing, updating, and processing the models, and storing the intermediate and final results of the analyses carried out.

*PHP* and *MySQL* are employed to build websites. Yu; Yi (2010) hold that the design and implementation of websites based on *PHP* and *MySQL* have been the main tool of web development, seeing that they are free and open-sourced. A database allows to store, search, classify, and retrieve data efficiently. *MySQL* controls data access to ensure that only authorized users are able to obtain access. Thus, *MySQL* is a multi-user server. *SQL* (Structured Query Language) is the standard language of database search worldwide (WELLING; THOMSON, 2003).

For the extraction of information (search/need) by the users, it is important to retrieve the knowledge and technology stored. That occurs when a student-intern needs specific information, resources that enable them to extract, memorize, share, and reuse the knowledge and technology at the right moment, in consonance with the purpose of a KMS to create the capability for different types of users to perform their activities (needs).

This subsystem needs to support the other elements of the framework proposal, manually feeding the knowledge repository with documents, information, knowledge, technology, and experiences arising from the processes and activities of academic internships. To that end, definitive storage is required.

The Content Management tool is a system for the electronic management of documents, encompassing best practices, lessons learned, product development, knowledge maps, customer knowledge, among others (RAO; OSEI-BRYSON, 2005). Also known as Electronic Document Management System (EDMS), it allows for the storage, indexing, and retrieval of documents stored (BRAGA et al., 2011).

The communication and memory subsystem of the KMS will allow the users, via an interface, to access data, information, knowledge, and technology, as well as stored documents for future queries or updates.

### Knowledge management system (KMS) usability

Usability concerns user satisfaction, facility to learn and solve tasks effectively and efficiently, and the collaborative and sharing process. For the integration of people, processes, technology, and content, the KMS usability makes use of the KM subprocess structure of Herrera; Bautista (2015): extraction, memorization, sharing, and reuse of knowledge and technology aligned with the user. The KMS usability is described as follows:

- extraction (search): it is characterized by the search algorithms that locate the knowledge and technology from different sources in the database. It allows the exchange of knowledge and technology (tacit information and/or primary or explicit information), experiences and competences between users through KM instruments. It also locates contents (keywords) in reports and other documents related to the internship.

- memorization (retain): resources, means utilized to collect/update knowledge/information continuously, offering proactive assistance to the knowledge workers (HERRERA; BAUTISTA, 2015). They preserve knowledge in a structured manner and represent it in the form of images, text files, databases, or videos. They are viewed as knowledge repositories, in addition to aiding in document management. Herrera and Bautista (2015) hold that Memorization encompasses the following aspects: it can retain (store) the most relevant type of knowledge necessary to support knowledge processes; the components Knowledge Repository System and Transitive Memory System emphasize the knowledge process which they can support better and directly; knowledge sources that support the Knowledge Extraction processes; specialized tools and procedures derived for potential Knowledge Reuse.

- sharing (transfer): exchange of explicit/tacit knowledge and technology between people, groups, communities or organizations (HERRERA; BAUTISTA, 2015). It is represented by the knowledge sharing tools of CIT in online or physical collaborative environments. The user transfers information, knowledge, and technology to the KMS, such as competence, supply, demand, and contents, acquired or related to the internship, which will be available for searches (stored) and retention (creating viable solutions that promote improvements and innovations), meeting the user needs and answering their questions.

- reuse (create): characterized by the incorporation of knowledge or technology (based on knowledge sources or stored contents) to regular or non-regular internship tasks (HERRERA; BAUTISTA, 2015). They aid and support the user's decision. They allow to synchronize different ways to cooperate and facilitate the visualization of contributions, encouraging the creation of new ideas.

Usability involves extraction, memorization, sharing, and reuse of integrated elements and of continuous interactions between the results from the practical activities performed by the student-intern and the other agents in Brazilian academic internships. They generate new information, knowledge, technology (tacit information and/or primary or explicit information), and experiences, which feed the repository.

## Indices (KMS Quality)

The indices will enable results concerning:

- the usability or utility (about the use of the KMS by users) of documents, texts, and KM instruments. Examples: number of messages and items in the KM instruments; number of participants; number of accesses in searches; number of interns per organization or area; among others. *MySQL* provides the data and relevant, reliable information, structured for meeting the user's needs;
- facility of use;
- the KMS quality as a strategic resource for the improvement and evolution of Brazilian academic internships;
- the number of student-interns per organization or EI, etc.

The indices concern the quality of the KMS use, in addition to metrics that may be utilized by the EI and the organization, related to the intern and internship activities. Measuring KMS performance is related to the assessment of learning technology. Thus, this framework is based on a logic combination of quality and user, previous KMS dimensions.

## User (Internal e External)

According to Townley (2003), the proposal of a KMS with a user-centered approach, based on the use of portals, is knowledge created in the research areas of interest and the search patterns developed by the users. The main actors involved are the student-intern, coordinator, professor, and supervisor, who all have knowledge needs of several types. The most relevant requisites of associated users were grouped according to the main knowledge processes involved (Extraction, Memorization, Sharing, and Reuse).

The main difficulties found in the stage of knowledge and technology sharing concern the accurate identification of knowledge needs and demands, the localization of apt sources available to transmit knowledge, competence management of sources and recipients necessary to make knowledge sharing feasible, management of organizational environment aspects, including beliefs and attitudes present in the internal culture that may impact the process (TONET; PAZ, 2006). The user will access the system through a register, via login and password, and will sign a term of commitment regarding sources, copyrights, and responsibilities within the environment.

The framework proposed constitutes an advantage in internship management, systematizing information, knowledge, and technology in Brazilian academic internships, allowing for a view of the possibilities and potentials of internship activities.

Regarding the adhesion in terms of CIT and human resources, the current infrastructure available in Brazilian EIs would meet the requirements, highlighting the viability of adoption. It is worth reinforcing that the framework encompasses the processes and activities in

Brazilian academic internships to transfer knowledge and technology and provide a structure of knowledge and technology repository centered on the user. It presents as negative points the user dependence and the lack of KM culture in the EIs. The interface constitutes the construction of a prototype knowledge portal for Brazilian academic internships, adopting the framework proposal for MKTT in the activities of Brazilian academic internships.

## Final Considerations

The KM approach to Brazilian academic internships aided in the reflection about the importance of the internship for professional qualification, that is, the learning experience provided by the internship practice and the knowledge transfer from individual knowledge to collective, enabling the student-intern to internalize and comprehend the organizational environment more easily.

In order to develop the framework for MKTT in Brazilian academic internships, the Organizational Environment (Educational Institution-Organization-Student/Intern) was employed to identify opportunities and problems and establish the viability of the knowledge actions intended for Brazilian academic internships. Also employed were the computational agents from knowledge engineering, communication and information technologies (CIT), and technologies supporting KM, in addition to KM instruments to support KTT in Brazilian academic internships, based on ontology learning and able to create, organize, formalize, share, apply, and refine knowledge and technology, in a user-centered proposal.

The framework elements, users and indices, present different functions in the KMS for Brazilian academic internships. KMS usability and the communication and memory subsystem of KMS support the knowledge repository and its management, in addition to systematizing and increasing the potential of the information, knowledge, and technology in Brazilian academic internships, constituting an advantage in internship management.

The activities in the internship process (management of documents and knowledge and technology created and organized) are managed by the framework's technological infrastructure, technological resources for communication and storage, which are formalized and shared by the different types of users, allowing for the application and enhancement of knowledge and technology, structure of the KMS usability.

The KMS usability, element that comprehends the KM structure, employs extraction, memorization, sharing, and reuse of knowledge and technology to ensure that adequate resources (inputs) are allocated for KM usability, considering the importance of process quality. The user transfers information, knowledge, and technology to the KMS as inputs acquired or related to the activities developed throughout the internships, which will be available (stored) for research and application, meeting the needs of users and answering their questions.

Usability involves the generation of new information, knowledge, technology (tacit information and/or primary or explicit information), and experiences through KM instruments and competences, which feed the repository. The element *Indices* will provide users with information about the KMS use quality, the university and organization, and reports with strategic information, including expertise or techniques.

This research's contribution lies in the reformulation of the Internship Management System, which acquires the KM approach in its process and, more specifically, viability to create, organize, formalize, share, apply, and refine knowledge and technology through a structured, systematized, and formal environment, with the purpose of transforming individual knowledge into collective knowledge, thus answering the starting question about how to transfer knowledge and technology in the EI-organization interaction through the mechanism of academic internships in Brazil.

The framework for management of knowledge and technology transfer in Brazilian academic internships offers not only a knowledge management service to its users, but also a KMS with CIT resources in a learning platform, in which coordinators, professors, supervisors, and student-interns would be able to manage the internship and its activities, a web-based learning environment structured for the development of academic knowledge in professional competences.

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