Adaptation and personalization of learning management system, oriented to employees' role in enterprise context - literature review

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Abstract. In the digital age, the training in companies can be facilitated through a proper system to the company's demand. A learning platform personalized to the profile of employees can facilitate the selection of training that tailored to their roles. This research aims to investigate the existence of adaptation and personalization of learning management systems (LMS) in enterprise context, that facilitate the selection of learning's content suited for employees' roles. This study focuses on literature review to understand the importance of a personalized LMS in company, especially in selection of content that adequate to role of each employee.

Keywords: Enterprise, Professional training, e-Learning, Learning Management Systems, Personalization, Adaptation.

1 Introduction

Nowadays, an organization's training system is essential for its growth to reach its objectives, increasing competitiveness. From the employee's perspective, following training in the company where they work is seen as a right and duty that allows them to be valued in the job market, guarantee employability, obtain self-confidence, and perform their function. It enables the employee to achieve their personal performance [8].

An effective training process can facilitate the training and promote the contribution of knowledge flow to all functional sections within the organization. A well-structured learning system permits the acquisition of available knowledge and improves employees' skills [24].

Mass corporate training is sometimes ineffective and may not allow alignment between the company's objectives and the interests of its employees. Therefore, exist a need for the development and implementation of a method with personalization in the enterprise (or organizational) training system that provides a quick and easy adaptation to the context and requirements of any organization and its employees [3].

Disorientation in the selection of learning content can demotivate the learners. This demotivation can lead to various causes such as rejection of training, the employees following training that is irrelevant to their function, cost increase for the organization in the training process, or it is not fit for employee's competence. Therefore, to achieve the success of a training process, consider it is necessary to develop training programs that adapt to each position and employee´s role [4]; considering the learning system that adapts to participants' characteristics and facilitates the choice of adjusted content to the different groups of training is essential [8]. n this regard, it is fundamental that the platform feature must allow a personalization that concerns performance and facilitates the choice of content. Personalization can increase the efficiency and quality of training [7].

It was reported that despite the LMS's feature allowing for adaptation and personalization, e-learning in companies still faces resistance, such as technical issues, with the possibility that the companies are not taking full advantage of the LMS feature [1]. Some companies face it due to the lack of direction as to who uses it and what it is used for or does not enhance the interests of employees [6].

According to the consulted literature, the problem that motivates this investigation is **a reduced number of learning management systems that facilitate employees to select training content essential to perform their function**.

In order to search for scientific evidence about the problem above presented, we conducted a literature review. The papers that were obtained with this methodology can lead to understanding the type and existence solution of Learning Management Systems (LMS), the possibility for an adaptive and personalized LMS, and the reason to personalize the LMS in companies.

To achieve the objective of this investigation, we formulated three research questions (RQ). Through the review, we found the literature that we will use as references to answer the RQ, as follows:

1. What types of Learning Management Systems (LMS) allow content adaptation and personalization?
2. How do the adaptation and personalization of an LMS facilitate the selection of learning content?
3. Why do companies need to personalize their LMS?

2 Literature Review

Based on [14], this research follows three phases as follows:

- Planning the review - identification of the review need, the research questions specification, and developing a review protocol (illustrated in Fig. 1). This step is presented in section 2.1.
- Conducting the review - primary papers selection and data extraction using the review protocol developed in the first step. This step is presented in section 2.2.
- Reporting the review - summarize the extracted data and report the results. This step is presented in section 2.3.

2.1 Planning the Review

This section presents our motivation for this work and then the Review Protocol.

Motivation. A learning process in an organization must be organized carefully to achieve success. Its benefits are not only for employees but also for the organization. Through the development of training within an organization, employees can gain knowledge and skills that can help to prosecute their role.

A learning structure is an essential element in organizations or companies. The development of a learning structure and choosing the right LMS as a tool to manage the learning system in an organization are fundamental to reaching the goals [1].

To achieve the success of a learning process, the company must consider the importance of the learning system that adapts to the characteristics and profile of each participant and adjust content to the different groups of trainees [8] & [21].

The personalization of the LMS implemented in the company must take into account the satisfaction of employees in using it [6]. The adoption of LMS allows companies to personalize learning content [10]. A platform that clearly indicates the content adjusted for employees can facilitate the selection of training [3]. In addition, content that is suited to their role can benefit and improve their performance.

Review Protocol. The first step of the Review Protocol (see Fig. 1) is started by defining the search string that will be used to search in the chosen databases to obtain the maximum number of papers that can answer the proposed research questions.

Fig. 1. Review Protocol

The search string and databases used in our research are list below:

Search string: (Enterprise OR organization OR corporate OR company) AND (professional training OR e-Learning OR "distance learning") AND ("Learning Management Systems" OR LMS OR "Learning Content Management Systems" OR LCMS OR "Content Management Systems" OR CMS OR "Knowledge Management Systems" OR KMS)

Databases: EBSCO and Scopus

The second step is defining the Inclusion and Exclusion Criteria and applying them to filter the set of papers that we obtained in the first step. The criteria are presented in Table. 1.
The set of papers that was obtained after applying the defined criteria must be analyzed by all abstracts and conclusions to decide whether they were relevant to the research.
The chosen papers were fully read to get the final paper set.

Rayyan was utilized as a tool to facilitate the selection of papers.
Only the complete papers, available in the chosen databases, written in English, Portuguese, and Spanish, with the author identification, including title, year, objectives, volume, methodology, results, and conclusion were considered. The search was limited to the last 5 years, that is, from 2016 until 2021, considering that e-learning and LMS are becoming a trend in the digital era with rapid development in many aspects. Hence, the period of five years is ideal to be referenced in this research.

Table. 1. Inclusion and Exclusion Criteria

Inclusion Criteria	**Exclusion Criteria**
Full text	Language: German, French and Russian
Peer reviewed	Date published: before 2016
Source types: Academic Journal and Conference Materials	Source types: Books and Reports
Date published: 2016 - 2021	Duplicates papers
Language: English, Portuguese, and Spanish	Title out of context, abstract, and inaccessible

2.2 Conducting the Review

The second phase of the literature review consists of conducting the review, where the selection of primary studies occurs according to a given inclusion and exclusion criteria. It started by performing the search using the search query to the databases selected in the defined review protocol and then analyzing the extracted data.

Selection of Studies. The paper selection was based on the search string. By applying it to the databases defined in the review protocol, we obtained 328 papers. By application of the inclusion and exclusion criteria, 41 papers were retrieved for more detailed analyses. Each one of the 41 papers was read completely, getting a total of 20 relevant papers for our research. The paper's selection process is illustrated in Fig. 2.

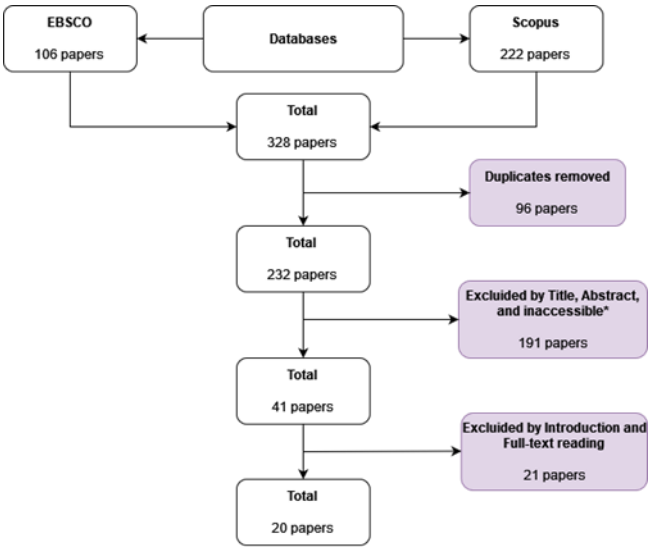

Fig. 2. Papers Selection Process

Data Extraction Analysis. In this section, we present the different parameter analyses of the selected papers, such as the distribution over the years and the type of publication. As it is possible to notice in Fig. 3, most of the papers selected for this research are from 2021.

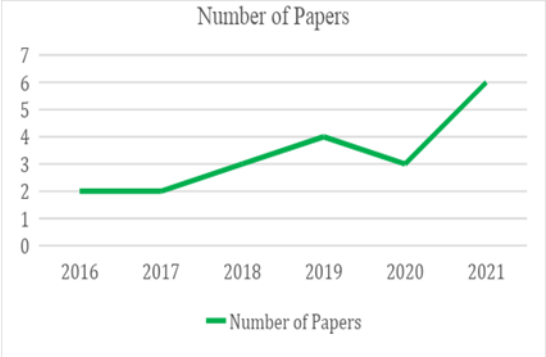

Fig. 3. Distribution of the selected papers over the years

The most common source type among selected papers is Journal, about 80%. Other papers are 5% from conferences and 15 % from magazines. This distribution is illustrated in Fig. 4.

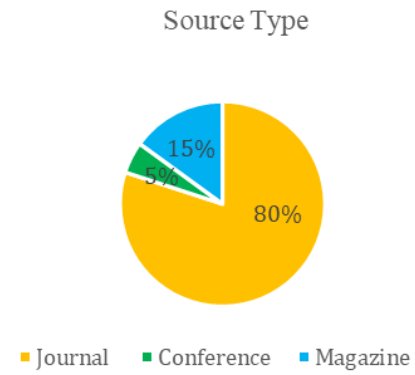

Fig. 4. Publication Type of the selected papers

2.3 Reporting the Review

We present here, the last phase. The results from the analysis of each selected paper and the corresponding collected information, allowing to answer the previously defined research questions. Table. 2 presents the list of 20 papers obtained through the execution of the literature review.

Table. 2. List of papers obtained based on the Search string

Author (year)	Title	Objective of Study
Alazemi, B. F. et al. (2021)	Learning Management Systems (LMS) and Future Vision.	Identify the current Learning Management Systems (LMS) applications and future vision.
Angelova, M. (2019)	Corporate Trainings–opportunities and challenges for employees and managers.	Explores the opportunities of training to the employees and managers and explains the challenges of corporate training.
Anton, C., et al. (2018)	The method of personalized corporate e-learning based on personal traits of employees.	The method of personalized corporate e-learning.
Bakanova, A. P., et al. (2018)	The concept of personalized e-learning with the use of mobile applications based on ontologies.	Describes the content of the developed concept of personalized corporate e-learning using mobile applications based on ontologies.
Bentaib, M., et al. (2021)	Adaptive Help System Based on Learners "Digital Traces" and Learning Styles.	Investigate the benefits of integrating learning styles in the Web-based educational systems.
Díaz Redondo, R. P., et al. (2021)	Integrating micro-learning content in traditional e-learning platforms.	Introduce a proposal to add micro-learning content to traditional LMS.
Gladilina, I., et al. (2020)	Efficiency of employee learning in small companies under conditions of digital economy: Searching for optimum solutions.	analysis of main features of modern e-learning systems (LMS) and employee training systems (TMS) in small IT companies.

Author (year)	Title	Objective of Study
Hamse et al. (2021)	Identification and Learning Styles' Variation Factors for a Hybrid and Distance Learning Professional Training ODL-SPOC.	Analyze the learning styles' variation of Physical Education and Sports'(PES) trainee teachers in relation with demographic factors, type of hybrid or distance training.
Herrera-Cubides, J. F., et al. (2019)	LMS SaaS: Una alternativa para la formación virtual.	Exploration about the alternative of using SaaS LMS as alternative management in e-learning.
Kavitha, V., et al. (2019)	A critical study on the use of artificial intelligence, e-Learning technology and tools to enhance the learners experience.	The role of artificial intelligence (AI) to enhance the virtual learning environment in e-Learning.
Kotova, E. E. (2017)	Use of intelligent agents in the learning process management tasks.	The educational process management at the point of view of computer technology.
Lalitha, T. B., et al. (2020)	Personalised Self-Directed Learning Recommendation System.	Propose the solution for e-learning recommendation issues on SDL (self-directed learners) method.
Oliveira, P. C. et al. (2016)	Learning Management Systems (LMS) and E-Learning Management: An Integrative Review and Research.	Analyze the available literature about the application of LMS for the e-learning management.
Sadikin, M., et al. (2019)	Load balancing clustering on moodle LMS to overcome performance issue of e-learning system.	The implementation of Load Balancing Clustering (LBC) mechanism applied to Moodle LMS in an HE Institution to deal with the poor performance issues.
Shurygin, V., et al. (a) (2021)	Universal Models and Platforms in E-Learning.	Search for the best solutions, models, and platforms to ensure the success of e-learning,
Shurygin, V., et al. (b) (2021)	Learning Management Systems in Academic and Corporate Distance Education.	Learning management systems in academic and corporate distance education.
Ülker, D., et al. (2016)	Learning Management Systems and Comparison of Open Source Learning Management Systems and Proprietary Learning Management Systems.	Discuss e-learning and the concept of LMS and examine open source LMSs
Vesin, B., et al. (2018)	Learning in smart environments: user-centered design and analytics of an adaptive learning system.	Apply user-centered design approach to further develop ProTuS with additional components that will support users to utilizing smart content
Wu, W., et al. (2021)	E-Learning Based on Cloud Computing.	Provides a theoretical overview of e-learning cloud architecture layers and models of its deployment in the education system.
Zahari, A. S. M., et al. (2020)	Knowledge management and e-Learning in organisations.	Discuss the importance of Knowledge Management in organising e-learning.

Based on the list above, we will summarize in three tables, which papers related to each research question (RQ):

- Table. 3 the list of papers to answer the RQ1
- Table. 4 the list of papers to answer the RQ2
- Table. 5 the list of papers to answer RQ3.

RQ1. What types of Learning Management Systems (LMS) allow content adaptation and personalization?

Type and solution of LMS. An LMS is a tool that can provide a learning and e-learning environment in an organization. Conform [2] one of the benefits of enterprise e-learning is the possibility to personalize the training; specifically, the author in [2] wrote that "Russian researchers probe maybe one of the most indisputable benefits of the corporate e-learning – the possibility to personalize the training. They focus on the specific situation when an employee changes its position in the company and obviously needs support, new knowledge, and skills which e-learning could provide and elaborate a method for personalization of e-learning corporate training".

Adopt an LMS in companies that intend to modify specific courses for their employees allows them to personify the e-learning contents and satisfy the needs of unique groups or particular characteristics of employees [10].

Various authors mention the types of LMS such as the open-source, those are free versions (e.g., Moodle, Canvas, Dokeo, Breeze, Sakai) and commercial versions (e.g., Blackboard, E-Front, WebAula) ([1, 10, 17, 18, 19, 20, 21, 22]). Further, they describe open-source LMS as a viable solution for e-learning that is available worldwide, robust, reliable, personalizable, and secure [1]. Commercial (or private) platforms are designed to meet the organization's specific needs [25]. Another example is the customization of LMS Moodle can be integrated with the library system in order to facilitate the training references requirement [18].

A variety of LMS such as Moodle, Canvas, and TalentLMS, is easy to use and usually used in corporate learning [19]. The author in [1] explains that as an open-source LMS, Moodle is designed for e-learning. It uses the most advanced object-oriented programming. The programming makes Moodle an efficient and effective platform, allowing any users to personalize according to their characteristics and needs.

Other authors describe that the learning system uses virtual platforms, allowing one to adapt and select information, learning resources, and collaboration. The personalization of the learning environment can be reached when companies focus on the individual potential development of each trainee [19].

Using LMS under SaaS (Software as a Service) like Blackboard, is an alternative cloud-based e-learning ([1, 5, 12, 19, 25, 21]), enabling companies to offer users a personal experience tailored to their own contexts, as written in [12] "permite a las empresas ofrecer a los usuarios experiencias personales adaptadas a sus propios contextos, lo que permite una experiencia más centrada en el usuario".

To enhance the user experience, facilitate learning, and adjust the course content to the needs of each learner, artificial intelligence (AI) has been integrated into the LMS [19]. In [21] confirm that divers platforms used in education, develop and create more personalization and adaptive experience in learning. For that, they introduce data-driven learning activities and learning analytics (LA) in their utilized system..

Moreover, [13] explain that utilizing AI could improve the learning experience, personalized resources, and the best outcomes. The system with AI integrated could collect essential user data, cross the information, and search the adjusted content for the learner.

Table. 3 presents the types and solutions proposed by the authors of 13 papers analyzed and respective references.

Table. 3. Type and solution of Learning Management System (LMS)

Type		Source
Private LMS	Blackboard, E-Front, WebAula	[1]; [10]; [17]; [25]; [20]; [21]; [22]
Open Source LMS	Moodle; Canvas, Breeze, Sakai,	[1]; [10]; [17]; [18]; [19]; [30]; [31]
Integrate the micro-learning (micro-content) approach into LMS	Grovo, Moodle	[9]
SaaS LMS	BlackBoard, Canvas, TalenTLms	[12]
Artificial intelligence (AI) in LMS	Docebo	[13]; [19]; [21]
LMS cloud-based and self-hosted	ELearning247, eDucativa	[1]; [5]; [12]; [19]; [21]; [25]

Fig. 5 is captured from [10], illustrates the comparison between commercial (private) and open source LMS. As shown in line of *development*, we can assume that all the types of LMS permit an adaptation according to organizations' demand.

Criterion	Open source LMS	Commercial LMS
Cost	Nearly all products are free.	Licensed products and their updates are supplied for fee.
Technical support	Technical support is based on questions and answers in user forms and open documentation of provider. In some cases, participation of professional consultant is stipulated.	Supplying company provides technical support according to service agreement.
Hardware	LMS is hosted on company's own server. Qualified personnel is required for maintenance. The server can be rented out or outsourced	According to the agreement, LMS can be hosted on its own server or on the supplier servers.
Scaling up	LMS can be scaled up so that to serve 50 or 5,000 users with the same quality.	The scaling up is guaranteed by supplying company.
Development	Using the LMS programming language, it can be unlimitedly developed according to company's demands. Ready solutions can be obtained by purchasing appropriate plugins.	Development is performed by supplier's initiative. The supplying company, aiming at high level of satisfaction of customers, improves the product, though, the result may not meet demands of a specific company. In this case, according to the agreement, solutions to such issues can involve supplemental payments.
Safety	The company should protect all data in LMS. Since the open source systems are being developed by thousands of persons, their vulnerability can be rapidly detected and eliminated.	In general, the safety is guaranteed by supplying company. Safety failures can be accompanied by data loss and leakage. In order to avoid such consequences, before contract conclusion it is necessary to analyze reliability and competence of the supplying company.
Integration	Since the source codes are open for adaptation to existing external systems, all projects can be implemented as it is provided by LMS architecture.	Since the source codes are closed, the integration depends on the supplying company. Possible integration and availability of special offers should be agreed preliminary with the supplying company.

Note: on the basis of expert survey

Fig. 5. Comparative analysis of commercial and open-source LMS captured from [10]

RQ2. How do the adaptation and personalization of the LMS facilitate the selection of learning content?

The base of adaptation and personalization of LMS. The LMS features describes that is possible to adapt and personalize the LMS. That can be "focus the adaptation and personalize of the learning platform on the requirements and needs of the

participants" [1], "provide different solutions to the particular needs" [9] or individual needs ([16, 19, 21]. The authors have proposed to use the employee's basic profile to personalize the training system in corporate training [3].

Particularly, the authors in [2] assume that corporate training is initially delineated by enterprise needs, but the training is an individual performance of an employee. Hence, a personal path construction of an employee as e trainee is considered necessary to provide training that meets the individual requirements.

Other bases of adaptation and personalization of LMS are the employee's role [3], the employee's profile (4, 24], and individual characteristics [15] or personal traits of the learner [2, 21]. Conform [19], the LMS features allow to fill each student's needs and provide a unique experience in learning, through the creation of a learning path utilizing the different courses.

Training based on employees' gained knowledge and desired career paths in the company is another approach that can be implemented to personalize the LMS [11, 16]. This strategy allows employees to follow adaptive learning as desired [20].

The introduction of the learning analytic (LA) components in the learning system facilitate the learning context [21].

In [10] explains, companies can use LMS to modify certain training, adapt for their employees, and manage the training content.

Table. 4 presents the base elements for the adaptation and personalization of LMS, referring to 11 papers analyzed to answer this RQ.

Table. 4. The base of adaptation and personalization of LMS

The Base	Paper
Requirements and needs of the participants	[1]; 7]; [16]; [19]; [21]
Individual/personal traits of learner	[2]; [3]; [15]; [16]; [19]; [21]; [24]
Tailor to employee's role	[3]
Employee's profile	[4]; [24]
Knowledge level and relevancy of the learner	[11]; [16]

RQ3. Why do companies need to personalize their LMS?

Reasons for personalization of the LMS. The literature evidence that the personalization of the system to manage the learning process has several important objectives. Several authors have mentioned personalization, both, in learning systems in general and in an enterprise context.

In [19], the authors have linked personalization with the significance of the influence of students' involvement in their learning and outcomes. Therefore, personalization is the essential key to reaching effective learning and career growth.

The personalization of the training system according to individual educational paths can facilitate the analysis and assessment of an employee's skills, allowing the provision of the necessary training to improve performance in their current role or eventually a new one [2]. The strategy permits the company can guarantee training effectiveness and efficiency since it focuses on individual and professional needs. The personalization of the learning system in the company is also related to employees'

motivation regarding their training. Considering the individual character of training, the company should provide training that satisfies the determinate need of its employees to improve satisfaction in the training process [2].

Analyzing the diagram in Fig. 6 can lead to understanding how the personalization of the training system, according to the need for new knowledge of the employee, can affect the individual result in the work and the improvement level of the company in the market.

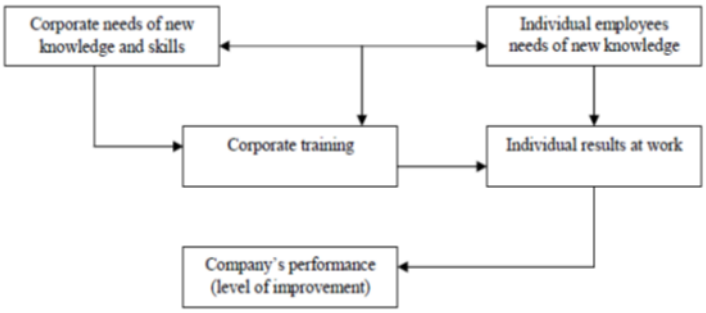

Fig. 6. Complex character of a corporate formation (Captured from [2])

In their research [3], the authors proposed the implementation of e-learning with a personalized system based on competencies and employee training paths. That allows a company to organize training that addresses the missing skills of each employee. The authors also argued that personalization in e-learning systems aims to improve motivation and the quality of training in the company.

There are people who have the motivation to learn, but don't know where to start [16], in this sense, the authors recommended the personalization of the system for autonomous learning. They explain a personalized system to manage e-learning in companies can help an employee to find the right direction and where to start adequate training.

After comparing five e-learning platforms, iSpring Online, WebTutor, Mirapolis, LMS Teachbase, and Moodle, the authors in [25] concluded that the platforms of e-learning have pros and cons. The ease of using the LMS platform leans on how it can be adapted easily to the need of its users.

Table. 5 presents the reasons for personalizing the LMS in companies/organizations, based on 5 papers used to answer this research question.

Table. 5. Reasons for personalizing the LMS in company/organization

Reasons	Source
Greater student involvement in their own learning and outcomes.	[19]
Provide necessary training to improve performance in the current role of employees.	[2]; [3]
Possible to offer training, focused on each employee's missing skills; enables an employee to follow useful training for the current or new role; improve motivation and quality of training in the company.	[3]
Autonomous learning; facilitates and guides an employee to select adequate training.	[16]
Ease of use of the e-learning platform.	[25]

3 Conclusion and future research

By executing a literature review, it was possible to verify the types of LMS. Moreover, lead to understanding on which aspect and element the adaptation and personalization of learning systems are based.

The literature demonstrates the existence of solutions to adapt and personalize an LMS that can be adopted and implemented in companies (or organizations). Any LMS used in organizational training allows the adaptation and personalization according to the demands of the company and its employees. Take into perspective that could be depended on the agreements between the companies and providers.

Most of the authors conclude that companies or organizations should consider the development of personalization in their training systems to benefit and achieve the best results. They also agreed that adapting and personalizing the LMS that focuses on individual needs can increase motivation and facilitate the uptake of training.

In our viewpoint, facilitating the selection of learning content oriented to employees' roles is crucial. Based on the literature, the ease of an employee to select the training content that adapts to his/her role can be achieved through personalization, as explained by the authors in these studies (e.g., through individual profiles, characteristics, and previous knowledge). Since most of the LMS available on the market offer features for personalization, organizations can use these vantages to obtain better results and return on investment from their learning area.

Additionally, based on this literature review, we have noticed the small number or lack within the personalization of LMS that facilitates employees to select adequate training content. We found that some organizations or companies already use the feature of LMS to enhance their training system. Even though that lack can become a problem in the training process, for example, demotivation to follow or complete the training, the employees must follow the training that is not related to their function or the training's contents not oriented to employees' role.

To understand this problem in a real enterprise context, in future work, we will conduct the survey research methodology. The survey aims to inquire about the existence of adaptation and personalization of learning management systems (LMS) in

enterprise contexts that facilitate the selection of training content tailored to employees' roles.

For our survey, we are going to focus on a questionnaire survey. Through this methodology, we try to get answers to whether or not companies personalize their LMS for this purpose. In the execution of this methodology, the target audience is the employees of companies or organizations in general scope that use LMS in their online training system.

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