Learning Analytics Framework Applied to Training Context:

A Systematic Literature Review

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***Abstract*— Currently, business organizations are struggling with the increasing demand for learning needs to address their knowledge gaps. They must have a structure that can reach all employees in terms of training and extract all the important data which is collected by Learning Management Systems during the instruction or learning process. This data will be of extreme importance for better business decisions. In this paper, it is presented a Systematic Literature Review with their respective phases duly explained and framed in the topic. It allowed us to understand the benefits, challenges, enablers, and inhibitors of the deployment and usage of a specified Teaching-Learning Analytics Framework. Finally, it is concluded, that the development of a reference model, could fulfill this gap in knowledge and help business organizations to allocate resources better and improve the decision-making process as well as an instructional and learning process. To achieve the final goal of this research, future work about the development of a Survey Research methodology will be started to fulfill this gap of knowledge.**

Keywords — Learning Analytics, Framework, Learning Management Systems, Learning Organization

I. INTRODUCTION

Currently, business organizations are struggling with the increasing demand for learning needs to address their knowledge gaps.

According to Alavi [1], knowledge is the organizational asset that allows a sustainable competitive advantage in hypercompetitive environments. In this sense, many organizations are developing information systems specifically designed to facilitate the sharing and integration of this knowledge. However, organizations are faced with reduced use of existing knowledge in these Learning Management Systems (LMS), and the great challenge in managing this knowledge is less its creation and more its capture and integration, and this knowledge has limited organizational value if not is shared [2]. The lack of a specific method of data analysis in these LMS, combined with inadequate and insufficient means and a poorly organized structure, leads to an increasing difficulty in managing and using this knowledge, generating a deficit in the perception of the value existing in this information.

As such, organizations make the use of Learning Analytics field to analyze learning data, which, according to Brown [3], refers to the entire process of systematically collecting and analyzing large sets of data from online sources to improve learning processes, and in this way generating value and feedback from the processed information. Al-Hunaiyyan [4] refers that it appears the technological management processes to support this knowledge in LMS, have difficulty in finding adequate support for the analysis of content applied in the organization, to make it an effective process for the collection and evaluation of this knowledge and a huge amount of data. This difficulty is transposed to the teacher or instructor of the LMS system, as a misuse of the LMS presupposes an inadequate collection and management of data and behavior patterns obtained for later analysis to address better management for benefit of organizations. Furthermore, it is shown in some cases where instructors have access to a variety of student data, there may not be organized efforts to support students across multiple courses [5]. The management difficulty by system users is also evidenced by Blackmon [5] when refers that is difficult to access learning analytics and ways to leverage learning analytics data across instructors and, in some cases, administrators, to create cross-disciplinary opportunities for comprehensive student support.

This paper starts with some research background with the overview of the most related subjects to this topic. Then, it is discussed the definition of one of the research methods that are going to be implemented: the Systematic Literature Review. We start by defining the research questions and presenting the systematic literature review related to the theme. The focus of the research is on the benefits and challenges of having a learning analytics framework applied

to a learning management system and the enablers and inhibitors of its deployment. The proposed approach chosen to solve the research problem will be focused on developing a teaching-learning analytics framework that will address the challenges and the problems appointed with the existing frameworks to improve the support and the process of teaching and learning, which will be planned and developed in future research. Finally, it is presented the future objectives that we pretend to achieve with this research.

II. Research Background

The following section presents a more in-depth overview of the topics that are essential to understanding the research. Consequently, a description of E-Learning, Learning Organization, Learning Analytics, Learning Management System, and Framework is given.

A. E-Learning

In the 21st century, the information and communication technology explosion increases the use of digital devices for many purposes in the world of work and in formal and non-formal education. E-learning (electronic learning) has become part of these educational purposes and the alternative of traditional education and also a complementary to it [6] Technologies can provide the means and tools for e-learning to take place in its preferred way and be distinguished from conventional learning because of its flexibility and adaptative strategies in teaching and learning to achieve the effectiveness of learning [7] According to Noesgaard [8], a structured search of library databases revealed that research examining the effectiveness of e-Learning has heavily increased within the last five years. At the same time, learning and development professionals within the public and private organizations are increasingly being asked to prove the effectiveness of their learning and development initiatives. The effectiveness of learning has become an important part of the Learning Analytics role when applied in Learning Management Systems.

B. Learning Organization (LO)

With the uncertainty and constant change of the environment, organizations and individuals need to have the flexibility and responsiveness to learn new skills and new abilities in order to thrive and have success or else their knowledge will become obsolete. Resistance to change appears to be personalized in organizations and members when it comes to the creation of new organizational knowledge mindsets [9]. Having that in mind we can understand that it may exists some confusion when it comes to organizational learning and its multitude of different levels of analysis which range from individuals to organizations and the diffusion of information within the organization and how individuals interpret and manage it in order to create a knowledge adaptive organization. So, we can perceive the organizational learning as an outcome brought through intervention [9] and can be seen with multiple constructs and dimensions which go from organizations as whole systems that that can adapt or change, according to their cognitive structures and policies, and as individuals that can develop, adapt or update their cognitive models becoming a whole process where an organization expands its range of action and focus on how the knowledge is attained and disseminated [9]. So, the main objective of an organization is to increase the capacity of individuals and organizational knowledge enhancers, giving the maximum attention to the change and the way in which it occurs, the flexibility and openness to innovative ways that are engaged to the organization goals and culture [10]. Therefore, we can consider a Learning Organization as an organization that is continuously increasing the skills and knowledge of its members, promoting collective learning conditioning organizational learning, and building organizational memory along the path [10].

C. Learning Management System (LMS)

According to Shurygin et al. [11], e-learning and distance technologies are being actively introduced into both academic and corporate education, as complementary to traditional forms. The efforts of teachers are aimed at finding effective models of learning. Education in an online environment is famous for its interactivity and opportunities to combine several teachings and learning strategies, so the Learning Management System (LMS) has been at the forefront in education, enabling the training process both online and offline. The top famous e-learning platforms include Moodle, Blackboard, Canvas, etc. Organizations, on the other hand, use LMSs to make sure that new and old employees have the necessary skills and competencies. They have also perceived that their training platforms can be used as a tool for continuous learning improvement beyond compatibility and adaptability.

D. Learning Analytics (LA)

Fahri Yilmaz [12] refers that the education model has changed over time. This change has created new situations such as individualized learning, determination of student behavior, and the use of alternative assessment tools. Learning Analytics (LA) is defined as measuring, collecting, and reporting data related to learners and learning environments to understand and improve learning and the surrounding environment. Its use creates opportunities for individualized learning, to determine the student behaviors associated with success by examining the student behaviors affecting success and serving as an alternative assessment tool. The main goal of learning analytics is to obtain meaningful results from the virtual learning environments to improve student outcomes in online learning environments by providing early warnings of students at risk of dropping out and better recommendations to tailor the learning path.

E. Framework

Defining Framework or a Reference Model, in line with Yosef Jabareen [13], it is stated that for a better understanding of complex phenomena linked to multiple bodies of knowledge that belong to different disciplines we require a multidisciplinary approach. Qualitative methods serve as adequate tools for investigating these complex phenomena. Following that we can define Framework or Conceptual Framework as a network, or "a plane," of interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena. The concepts that constitute a conceptual framework support one another, articulate their respective phenomena and establish a framework-specific philosophy. Conceptual frameworks are not merely collections of concepts but, rather, constructs in which each concept plays an integral role. They provide not a causal/analytical setting but, rather, an interpretative approach to social reality.

III. Systematic Literature Review

In this section of the paper, it is presented one of the research methodologies used in this research: the Systematic Literature Review (SLR).

Systematic Literature Review

A Systematic Literature Review (SLR) is a way of identifying, evaluating, and interpreting all available research relevant to a particular research question, topic area, or phenomenon of interest. The main goal of a Systematic Review is to synthesize existing work in a manner that is thorough, fair, and seen to be fair to be scientifically valuable[14]. This Systematic Literature Review was conducted following Kitchenham´s Procedures for Performing Systematic Reviews [14]. Therefore, the process was divided into three main steps:

- Planning – Identifies the need and motivation for a systematic review of a particular phenomenon to summarize all information in a thorough and unbiased manner.
- Conducting – involves the identification and selection of primary studies and their quality assessment using the review protocol developed in the first step. Finally, data is extracted and synthesized from these studies.
- Reporting – The extracted data is summarized and the results of the SLR are communicated effectively.

The chosen Research Methodology for this work was SLR since our main goal was to collect and summarize all the existing information concerning Learning Analytics Frameworks and their efficient deployment within an organizational context.

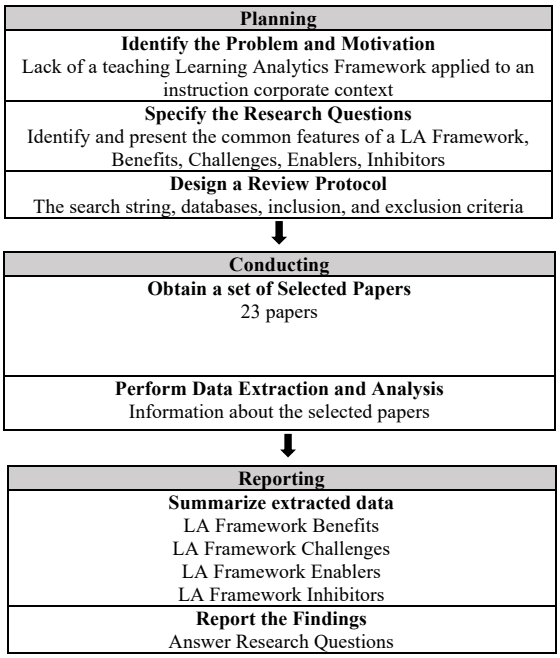


Fig. 1. Represents the threee steps of an SLR explained above and adapted to our research.

A. Planning the Review

In this section, we present the motivation for our research, and then we will present the Research Questions aimed at this research. We finish with the presentation of data sources and data strategies.

Motivation

Nowadays the evolution of technology and the need for learning is increasing in its complexity. Business Organizations and teaching staff require greater and better analytical tools to address these needs and understand learners' difficulties and gaps to be more informed in their decision-making process and increase the effectiveness of learning and teaching. The adding value of an efficient and easy-to-use learning analytical tool is of great importance to all stakeholders.

So, to address the current challenges and gaps of the existing teaching analytical tools we aim to develop a reference model that could easily be adapted to most of all Learning Management Systems to help teaching staff in their supervision and teaching role and maybe improve businesses with a solid scientific approach to make better instructional decisions. That why we first start with this SLR comparing to other SLR that exist about this topic.

The adding value of this SLR is present in the aggregation of several topics related to the implementation of AL tools in training contexts that are dispersed in other publications, allowing us to have a clearer and more understandable view

of this topic and thus start for an in-depth debate on what we can do to improve what already exists.

Research Questions

This research intends to make it clearer the status of Learning Analytics applied to a training organizational context. It targets the search for answers that fulfill the understanding of how we can efficiently implement a Learning Analytics Framework, what benefits come from this, what challenges we need to overcome, and what enablers and inhibitors we will face when implementing it.

As a result, the following research questions were developed to achieve that goal:

- **RQ1** – What are the benefits of implementing a Learning Analytics Framework in Learning Management Systems?
- **RQ2-** What are the challenges of a Learning Analytics Framework when applied in training contexts?
- **RQ3-** Which are the enablers of the deployment of a Teaching-Learning Analytics Framework?
- **RQ4-** Which are the inhibitors of the deployment of a Teaching-Learning Analytics Framework?

Data Sources and Search Strategy

After the need for a review was identified, and the review protocol determined, was selected literature that was based on search criteria (presented in Table 1) which resulted in a total of 67 articles.

B. Conducting the Review

In this section, we conduct the review (second phase of SLR), where we go through a selection of articles based on inclusion and exclusion criteria. The search was made with EBSCO and SCOPUS electronic library, ending with the final choice of SCOPUS as the selected library for the research.

TABLE I. SEARCH CRITERIA

Element	Research Details
Source	SCOPUS
Final Search String	AB ((Learning or "E-learning") and ("Learning Management System" or LMS or "Knowledge Management System" or KMS or "Learning Content Management System" or LCMS or "Content Management System" or CMS) and "Learning Analytics" and (Framework or Reference or Model))
Search Strategy	Abstract\Resume search of scientific articles from conference materials and academic journals with a date range limit (2016 to 2022) and a subject area limit (computer science)
Results	67

To obtain the final set of articles, a process of selection, data extraction, monitoring, and synthesis of the articles occurred (fig.2).

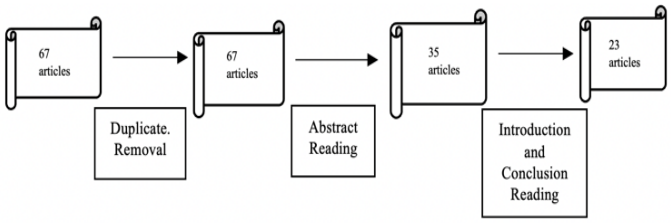


Fig. 2. Papers filtering process.

Inclusion and Exclusion Criteria

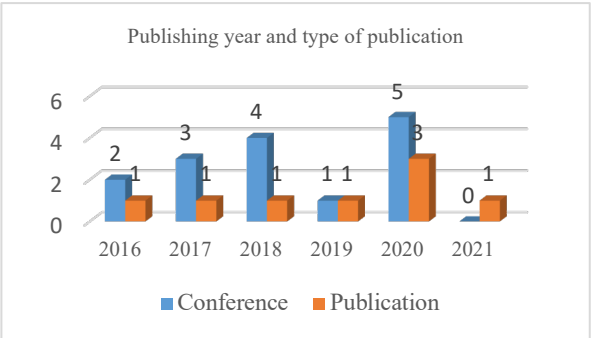
After selecting the articles related to the topic in the literature, we proceeded to the removal duplicates with the use of the Rayyan tool. Then, the titles and abstracts were read, and each paper was categorized into three different categories: "accepted", "rejected" and "maybe" which led to a sum of 35 articles accepted.
The final set of 23 articles was obtained through the reading of the introduction and conclusion.
The inclusion and exclusion criteria are shown below in table 2.

TABLE II. INCLUSION AND EXCLUSION CRITERIA

Inclusion Criteria	Exclusion Criteria
Papers from Scientific Journals and Conference	Different Subject
Full-text access	Before 2016
Only after 2016	Articles of Paid access
Articles of the related subject (e-learning, knowledge management systems, learning analytics, framework)	No duplicates
Limited to the subject area (computer science)	

The next table will present the year and type of publication of the selected articles for the research analysis. 2020 was the year with the most published articles related to the topic.

TABLE III. PUBLISHING YEAR AND TYPE OF PUBLICATION



The following table shows the number of publications of each specified conference, with LAK conference with most of the published articles.

TABLE IV. CONFERENCES

Conference	Nº of Publications
International Conference on Innovation, Practices, and Research in the Use of Educational Technologies in Tertiary Education (ASCILITE)	1
International Conference on Science, Engineering & Technology (ICSET)	1
IEEE Frontiers in Education Conference (FIE)	1
International Conference on Data Science, Technology and Applications (DATA)	1
Panhellenic Conference on Informatics (PCI)	1
International Conference on Computers in Education Workshop Proceedings (APSCE)	1
Technological Ecosystems for Enhancing Multiculturality Conference (TEEM)	1
International *Conference* on Learning Analytics & Knowledge (*LAK*)	5
IEEE International Conference Information Visualization (IV)	1
International Conference on Frontiers of Educational Technologies (ICFET)	1

C. Reporting the Review

In this section, it is presented the last phase of SLR methodology, where the results from the analysis of each selected paper and the collected information are given to answer the research questions that were previously defined.

TABLE V. ACADEMIC JOURNALS

Journal	Nº of Publications
Journal of the World Engineering Education Forum (Procedia)	1
IEEE Transactions on Learning Technologies (TLT)	1
Education Sciences Journal (MDPI)	1
International Journal of Engineering & Technology (IJET)	1
Journal of Computer Systems, Science & Engineering (Tech Science and Press)	1
Journal of Internet and Higher Education (IHEDUC)	1
Journal of E-Learning and Knowledge Society (JE-LKS)	1
Journal of Technology, Knowledge, and Learning	1
Journal of Learning Analytics (JLA)	1

Benefits of a Learning Analytics Framework Implementation

After a careful read of the literature we can check that the implementation of a Learning Analytics Framework in Learning Management Systems can have several benefits for learners, teaching staff, or even organizations. This list of benefits found in the literature is shown below in Table 6.

TABLE VI. BENEFITS OF IMPLEMENTING A LEARNING ANALYTICS FRAMEWORK

Benefits	Sources
Provides the analysis and collection of students´ learning process data to improve early warning and personalized recommendations to avoid retention and knowledge gaps.	[15][16][17][18][19][20][21] [22][23][24][25][26][27][28][29] [30][31]
Introduce new ways to improve the effectiveness of instruction	[15][19][20][24][27][28][29][30][31]
Drive senior management decisions to support organizational capacity and improve the learning process	[32][16][22][28][29][31]
Integration of interactive technologies improve learning efficiency	[15][19][21][22][30]
Improve the student´s positive attitude towards an individualized analysis of their learning path	[21][27][28][29][33]
Different levels of granularity improve knowledge discovery and teaching management	[34][25][29]
Allow intervening when inappropriate dispositions for the instructional design are present	[30]

As the context of learning has been changing over time and its importance is rising amongst learners, teaching staff and specially in organizations, the implementation of a specific Learning Analytics Framework in Learning Management Systems can bring the most mentioned benefit across the literature. It provides the analyses and collection of data from multiple sources which can predict learning outcomes and student retention by improving early warning and recommendation systems that provide personalized guidance, feedback, and support to learners while enabling teachers and instructors to better understand the needs and potential of their learners and intervene in the middle of their learning process [15], [21]. Another important benefit is that the introduction of new ways to systematically refine assess and improve the effectiveness of instruction to improve teaching and learning [15], can be done by integrating interactive technologies which can make the educational process more efficient and eliminate knowledge gaps [15] [21], promoting a positive attitude amongst students by the personalized analysis of their learning path and behavior patterns which can lead them to be aware of the changes on the approach they can make to their study progress [27]. The data extracted from these tools can be of great importance to an organization as it may act as an impetus to drive senior management to make decisions that support organizational capacity development in Learning Analytics and increase the power of LMS, improving teaching and learning [32]. Other less benefits but still important to mention, comes with the different levels of granularity which may improve knowledge

discovery allowing a better teaching management [34]. We may also mention the allowance to intervene when inappropriate dispositions for the instructional design are present [30] and improve the learning track making the best corrective measures that are possible, to achieve the desired success. Having all these benefits in mind we can understand that a proper Learning Analytics framework can provide learners with a personalized experience and improve future e-learning courses by helping instructors understand the learner´s path and helping them reach their learning goals.

Challenges of a Learning Analytics Framework when applied in training contexts

Understanding the evolution of online learning and learning analytics within specific contexts when it is applied, we can also report several challenges that need to be addressed when developing and implementing an LA Framework to a learning environment. The list of challenges reported in the literature is below in table 7.

TABLE VII. CHALLENGES OF A LA FRAMEWORK APPLIED IN TRAINING CONTEXTS

Challenges	Sources
Challenge to prepare a proper personalized instructional design to guarantee proficiency of the learning process	[15][21][26][27][35][30]
Need to identify and integrate advanced instructional methods and evaluation techniques to increase student´s engagement	[15][22][23][28][33]
Lack of regular supervision and feedback to provide support to the learning process more effectively to adjust the learning path	[16][24][27][28][35]
Integrated L.A. solutions and predefined types of L.O. and rules related to users learning styles are required to provide actionable information	[32][21][29][30]
Adaptable and intuitive analytic tools are required to meet the needs of stakeholders and course-specific contexts	[32][21][24][26]
Need to revise the intervention process to sharpen its effectiveness	[23][35][30]
The course should be designed with a variety of interactive activities and implemented regularly to be evaluated periodically	[24][35]
Difficulty in assisting learners to understand the acquired knowledge in-depth	[15][27]
Requires careful data manipulation and correct analytical models to avoid misinformation or invalid inferences	[18][24]
Challenge in articulating the nuanced dimensions of SRL due to inaccurate data	[36][29]
Diversification of traditional learning to online learning can pose a challenge	[22]
A design for teaching is required to encourage students to think critically and use creative skills in problem-solving	[20]
Lack of access to high-quality data, professional development in using data, and collaboration around its use	[18]
The need for evaluation protocols and digital competencies training should be consolidated	[37]
Traditional reporting included in LMS should be improved to satisfy the growing need	[25]
Need to present simple and powerful visualizations and suggestions of pedagogical actions to provide better feedback	[28]
Need for a shift in institutional culture leading to a management change that focuses on the value-adding role of L.A.	[31]

Some of the challenges come from the increasing development of the technology and the raise of the different stakeholder's needs and should be addressed accordingly to their importance and specific context where they are implemented. We can observe that one major challenge to overcome is the need to prepare a proper instructional design that guarantees the proficiency of newly trained learners as it heavily influences learner behavior [15] [21][35]. For that purpose, it is necessary to critically identify and integrate advanced instructional methods and proper evaluation techniques to increase student´s engagement and the success of the learning path [15] [21]. This situation may imply a lack of regular supervision and create some difficulty in assisting learners to understand and support the learning process more effectively in a manner that better feedback is given so the learning paths can be adjusted adequately [16] [27]. So, it is important to have in mind when developing this type of LA frameworks, the integration of predefined Learning Object types, rules related to user learning styles, and adaptable intuitive analytical tools, such as simple and power visualizations and suggestions of pedagogical actions, so the needs of all stakeholders are addressed to provide actionable information to ensure an effective learning environment, so students keep engaged [32] [21][30][28] and the needs of stakeholders are met and course-specific contexts. An important aspect to be mentioned is the need to have identified and integrated evaluation protocols and advanced instructional methods to increase student engagement and critical thinking [20][37][15]. One aspect that´s important to avoid misinformation or invalid inferences on prediction models is to handle carefully with data manipulation and analysis[18], so teaching staff should be better trained in digital competencies to improve the decision-making process and feedback [37]. One obstacle to mention is the difficulty in assisting learners to understand the acquired knowledge in depth [15]. Also, traditional reporting included in LMS must

be improved to satisfy the growing need to understand the extracted data [25]. The change of traditional diversified learning to online learning can pose a serious challenge [22] which may imply some concerns in organizations as they must shift their institutional culture leading to a change in management model and focus the message on the value-adding role of Learning Analytics [31].

Enablers of the deployment of a Teaching-Learning Analytics Framework

In this section, it is provided an answer to which are the enablers that help and address the implementation of a Teaching LA Framework, according to the literature. The list of enablers is shown below in table 8.

TABLE VIII. TEACHING ANALYTICS FRAMEWORK DEPLOYMENT ENABLERS

Enablers	Sources
Appropriateness of the medium used, the learning activities, and tend to interact with tools that are recommended	[15][26][28][29]
Enables teachers to identify and contact students at-risk of dropping out	[32][28][30]
Enables picture of learning outcomes so teaching staff can issue alerts to students and personalize the learning content	[16][21][27]
Allows consistent analysis of data which improves the decision-making process	[34][19][27]
Provides a set of evaluation metrics to test prediction models accuracy and student engagement	[17][22][28]
The use of the L.A. tools develops a student engagement model that supports effective teaching	[22][28][35]
Increasing investment and development in online learning and support	[16][30]
Rise of teaching analytics to support the learning process	[25][31]
Promotes an increasing focus on extraction and analysis of learner data to provide insights into patterns of SLR	[36]
Easy to reuse, allowing tutors with limited Machine Learning knowledge to predict student outcomes	[18]

The most common characteristic to enable the implementation of such framework mentioned in literature is the appropriateness of the medium used to deliver feedback and reminders, the learning activities, and the tendency to interact with tools that are directly recommended for use according to instructional conditions of the course [15][26][28]. Among the most important factors to enable the implementation, we have the consistency of data analysis which collaborates with the educational process, sending a clear picture of the learning outcomes to the teaching staff so they can identify and contact students at risk of dropping out and issue alerts and personalized recommendations to their learning path [32][16][34][27]. The use of Learning Analytics tools also enables student engagement and provides a set of evaluation metrics to test the prediction model's accuracy [22][28]. As the growing needs come to life with this kind of tools, its use is being promoted by organizations with the increasing investment and development and support in online learning [16] by the stimulation of an increasing focus on extraction and analysis of learner´s data to provide insights into learning patterns [36]. The easy to reuse of some of these tools also allow tutors with limited machine learning knowledge to predict student outcomes [18] and support effective teaching [22].

Inhibitors of the deployment of a Teaching-Learning Analytics Framework

Understanding the perpetual change of technology, it´s common to have impediments to the deployment of this type of framework. The list of these inhibitors is shown below in table 9.

TABLE IX. TEACHING ANALYTICS FRAMEWORK DEPLOYMENT INHIBITORS

Inhibitors	Sources
Cannot be replicated in different scenarios which cause restricted usage	[34][22][30]
Lack of specific framework design to capture the technology-enhanced learning process	[19][30][33]
Limited integration of L.A. in the context of immersive technologies	[15][30]
Lack of rigor and few systematic efforts in some studies when L.A. practices are discussed	[15][23]
Lack of leadership of a unified approach and inclusion of students to L.A. decision making	[32][29]
Excessive intrusion in student´s learning routines leads to discomfort due to excess control	[28][29]
Requires sufficient computer power to run	[17]
Increasing complexity of e-learning over time	[21]
Lack of predefined learning object types negatively affects the work of adaptive I.S.	[21]
Lack of attention to instructional conditions leading to over or underestimation of predictions	[26]
Elaboration of deep learning analytics is difficult and expensive	[27]
LMS is seen as a problematic platform for sending messages or using as a mobile application	[28]
Poor usability of LMS can lead to poor accessibility of information by students and teaching staff	[28]

Restrictions to the deployment of Teaching Learning Analytics Frameworks have various sources and can be found in the literature about this topic. To start, one major inhibitor

regarding the deployment of this tool is the lack of a specific design framework to capture technology-enhanced learning process [33][30] due to the increasing complexity of e-learning systems overtime which causes difficulty to know which learning style aspects are worth modeling in the new Information Systems with the lack of predefined LO types or other analytic tools that affect directly the work of adaptive IS [21]. Another important aspect related to inhibitors is that the integration of LA in the context of immersive technologies may be limited which can require sufficient computer power to run and elaborating deep analysis can be quite difficult and expensive [27][17][15]. Another major inhibitor is that these frameworks may not be generalized or replicated in different scenarios which restrict their usage making it impracticable to manage new knowledge [34][22]. LMS is seen as a problematic platform for sending messages or use it as a mobile application which may cause poor usability and lead to poor accessibility of information by students and staff [28]. Also, one major drawback to implement these tools is a lack of leadership of unified approach where inclusion of students to Learning Analytics decision making is poor and insufficient [32]. Finally, the lack of attention in designing the instructional conditions can be a major inhibitor of the framework deployment because it can lead to over or underestimation of certain predictors, causing misinformation on the analysis [26].

IV. DISCUSSION

In this section it is discussed the obtained results of the systematic literature review.
As a result, this systematic literature review, provides additional implementation features to improve the instructional and learning process.

The benefits of applying a Learning Analytics Framework are well mentioned in the existing literature pinpointing the major one when it refers that it provides the analyses and collection of data from multiple sources which can predict learning outcomes and student retention by improving early warning and recommendation systems that provide personalized guidance, feedback, and support to learners while enabling teachers and instructors to better understand the needs and potential of their learners and intervene in the middle of their learning process. Although approaching some of the mentioned benefits, this SLR contributes with an improvement of the existing ones and introduce others to better reshape and refine the learning and teaching path and impact in student´s positive attitude towards these new educational models and knowledge learning achievement.

Reviewing the challenges presented to the existing models we can see there is still a lot of work and research to be made to address them and this SLR will try to contribute to that knowledge path by presenting a proposal of a framework that will try to fulfill the gaps and be successfully deployed in any organization and business and give proper feedback with actionable information that can lead to an improvement of better business decisions and support. Instructional and appropriateness of the design are mentioned and should be a priority to address and a set of specific guidelines should be made to improve the supervision throughout all the learning process.

To conduct this research, a SLR was made, and a summary of results were gathered within a table of sources for each concept. The main information extracted from the selected papers are:

- Analysis and impact of the benefits of a LA framework implementation
- Raising awareness to the major challenges of a LA framework implementation that need to be overcome
- Analysis of a set of enablers that will impact the deployment of a LA teaching framework
- Analysis of a set of inhibitors that will impact the deployment of a LA teaching framework

V. RESEARCH PROBLEM

Often, businesses and institutions come across with some difficulties in managing the existing knowledge in LMS. It becomes of most importance to work it and make accessible to generate value other else it becomes useless and not shareable. It then becomes an impediment to generating strategic information that allows organizations to make better decisions about their human resources, business processes, and training management. This difficulty is transposed to the teacher or instructor of the LMS system, as a misuse of the LMS presupposes an inadequate collection and management of data and behavior patterns obtained for later analysis and treatment to show them in better management for benefit of organizations.

The adding value of an efficient and easy-to-use learning analytical tool is of great importance to all stakeholders and essential to address the current challenges and gaps of the existing learning analytical tools.

Objective of the Research

The main objective of this research is to focus on the deep analysis of Learning Analytic Models found on literature when applied in Learning Management Systems (LMS), evaluating the respective impact for learners, teaching staff, and organizations.

This analysis should highlight the respective benefits, challenges, enablers, and inhibitors that users with the profile of teachers or instructors encounter, in a relevant use of these

LMS models, demonstrating the impact or not that this use has on the Learning Analytics models of the organizations themselves.

Based on the previous analysis, the result of this research will try to end up with the development of a new Reference Model of a Teaching-Learning Analytics Framework that can be deployed in almost every organization and help in the better decision-making process and teaching effectiveness.

Methodology to be applied in future work

Following our Systematic Literature Review we will try to address our research problem by adopting the Survey Research methodology to analyze, evaluate and develop the reference model we propose. We have selected this methodology because it can be used to answer questions that have been raised, to solve problems that have been posed or observed, to assess needs and set goals, to describe what exists, in what amount and context and finally to determine whether specific objectives have been met or not and establish baselines for future comparisons and trends [38].

With the questions and problems that have been raised in SLR, we will try to develop a first draft of a new Learning Analytics Framework to answer the Research questions previously defined and explained.

For this research and development of a new LA framework we will depart from one of the most used Learning Management platforms which is Moodle. From there, we will apply Survey Research methodology to evaluate our framework proposed draft with the selected professionals from our field of study. To perform that task, we first need to understand how this methodology is prepared for better efficiency and to obtain the best results from data analysis and management.

Therefore, we can divide the methodology into four phases [38]:

- Survey design – sample selection and determination of sample size
- Survey instrument development – define the objective and focus of the study
- Survey execution – testing the instrument and procedures, conduction of the survey, data collection and process
- Data analysis and reporting of results – analysis of data and reporting of the results

Below it is presented the survey research process flow [39]:

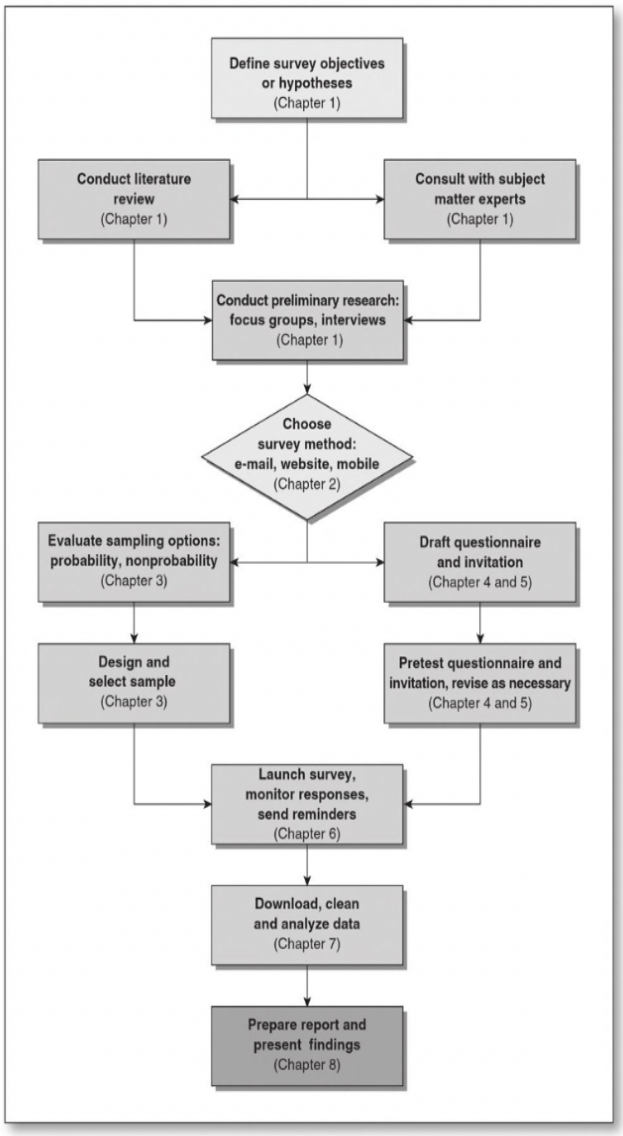


Fig. 3. Survey Research process flow.

According to the main objective of our research we will choose the questionnaire survey as the most appropriated method to obtain data and draw some conclusions about our proposed model. This method will consist of questioning a group of respondents which are representative of a population (selected professionals of our field of study), regarding their opinions related to any point that interests researchers (e.g., problem, event, or knowledge level) [40].

For our research, the questionnaire will be designed following a set of specific guidelines and according to the context of the study (organizational training context), regarding our Learning Analytics framework proposed draft. To proceed with this method, we will select an audience of business sector or general training professionals within public or private organizations.

After collecting data from the questionnaires, we will proceed to statistical analysis of it (e.g., SPSS) and draw some conclusions about the findings. The main goal to choose this methodology is that we can analyze the extracted data from the survey and identify patterns in the questionnaires which may be of great importance to evaluate and validate our proposed framework and implement corrective measures that can lead us to an important breakthrough in Learning Analytics frameworks.

VI. CONCLUSION AND FUTURE WORK

In this report, we conducted a Systematic Literature Review. With the Systematic Literature Review, it was possible to identify relevant articles related to Learning Analytics reference models and their intrinsic characteristics which led us to understand the important role of this type of tools to improve teaching and learning process and how we can go from an "as is" architecture to a "to be" architecture" of the model concerning its benefits, challenges, deployment enablers, and deployment inhibitors.
With that research, we believe it was possible to compile and summarize important information related to this topic which didn´t exist only in a single document.

One major limitation to the topic research was the context, as most of the studies in literature do not approach specifically instructional learning analytics applied in corporate context but mostly in educational organizations or other related institutions. This may imply that probably most of the business organizations use the existing LMS that are applied in educational institutions.

From the research, the lack of proper framework design without predefined learning object types or proper analytical tools with clear rules and better instructional design can lead to misinformation and inferences on predictors which can impact learning decisions. Lack of regular supervision and specific training to deal with data is also mentioned.

For the future, we expect to develop a new model that can try to solve this issue among other problems previously identified in the SLR and be used and implemented by business or vocational organizations to address their learning capabilities and processes. For that purpose, we will follow the Survey Research methodology (briefly explained above) to gather valuable data from rigorously selected specialist professionals working in the field of study in order to statistically analyze the data and reach meaningful research conclusions to evaluate, improve and develop the reference model that we propose.

Despite all this research about the topic, further research is needed to address the challenges that arise with the evolution of Learning Analytics.

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