

Integration of Learning Management System Technology and Social Networking Sites in the E-Learning Mode: A Review and Discussion

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Abstract—Literature explores the technological development that universities have gone through and that they are currently facing, especially with the use of new technologies about information and communication (TIC) applied to the teaching-learning process, so several models have been created also theories to adopt technology in the educational field, such as learning management systems (LMS) and social networking sites (SNS) both in the electronic learning (eLearning) and learning blended (bLearning) modalities, which are the object of analysis from different theoretical frameworks, try to identify determining characteristics about their use and the impact on the educational process. Studies that were analyzed tend to consider that the synergy of these tools, mostly from a technological approach where importance is given to the "e" (electronic) and neglecting the "Learning" have led to think that each of these approaches that characterize these tools individually could be achieved by combining the best attributes of the LMS with the SNS in order to maximize the strengths and reduce the weaknesses of both tools, integrating technological approaches, pedagogical, social and cognitive.

Keywords— Electronic learning models, SNS-LMS, Blended Learning, Higher Education, Educational innovation.

I. INTRODUCTION

Nowadays education in a general sense, essentially higher education, has been forced to be the compass of guidance to navigate in a complex and excited world. Thus, technological development is profoundly affecting the activities carried out by students. The information society has evolved ways of obtaining knowledge through the constant innovation of learning technologies, taking into consideration that educational institutions are no longer the only source of knowledge acquisition, and sometimes not even the main one, for students in many fields of education. Students have many sources of information, which are generally presented in formats that are usually more attractive; therefore, what the students require is not the information, which they may undoubtedly need, but the ability to organize and interpret it to give it a cognitive sense of learning. Above all, they need to project themselves as future citizens with skills and precision to search, select and interpret information [1].

In recent times, scenarios of educational training are beginning to undergo important changes, mainly with the emergence of new technologies and more specifically with the influence of learning management systems (LMS) and social networking sites (SNS). This implies that "traditional" education systems must reflect on the incorporation and integration of technological platforms in the educational process. Universities have constantly tried to implement the LMS in the formal educational process, adding the advances in information and communication technology (ICT) in the attempt to resolve the demands. Studies confirm an instrumental and functional use of the platform, which is mainly being used as a repository for materials and information, while its pedagogical use remains limited. This is becoming a problem in higher education institutions, something that requires debate and reflection from a systemic perspective on the adoption and integration of technology in the classroom [2].

Research has shown that many teachers only use a minimum of LMS's possibilities [3]. More clearly, the 'Study of Undergraduate Students and Information Technology 2017' ECAR report notes that 75% use institutional LMSs mainly for tasks related to uploading the course syllabus, publishing materials, delivering notes and requesting and collecting homework.

However, it is essential for technology integration in the classroom to involve teacher training to understand not only technological and instrumental technology but also what is beginning to be called pedagogical and

content knowledge [4]. To this end, on the one hand, it is necessary to rethink teacher-centered teaching approaches and direct them towards a student-centered approach on the other hand, it is necessary to look for new ways and approaches to carry it out.

On the other hand, the SNS attract the attention of the student in the social field, communication, collaboration, interaction and, therefore, their adherence to them; characteristics that can significantly help in the integration of this tool in the teaching-learning process. It is indisputable that the pedagogical, didactic and cognitive processes, in which education is sustained, need all the tools that ICT's offers to be able to fulfill their objectives. The challenge is to combine the best attributes of the LMS as a formal educational tool, with the functionalities of informal learning through the SNS, in order to maximize the strengths and decrease the weaknesses of both tools in the teaching-learning process.

A formal and informal educational process encourages the emergence of new theories, methodologies, models, tools and applications designed to make better use of the online medium, in order to facilitate the acquisition of knowledge and learning by the interested students, no matter age, gender or other personal conditions [5]. Technologies offer opportunities to access materials and information freely, either by shared resources in the SNS and the internet, or through educational tools provided by a tutor in the LMS, thus accessing an interactive, timely and flexible learning. LMS are platforms designed for formal educational use, which are relatively accepted by the academic community, whose main function is to benefit students to acquire knowledge facilitated by technology. However, students are not being responsibly accompanied in the execution of the learning process, the shared resources are not socialized, no discussion forums are presented where the interaction, collaboration, discussion by the students and educators are presented. The opposite happens with the SNS, where collaborative work is increased, improves retention of what has been learned, power critical thinking and the diversity of knowledge. From this perspective, the two approaches must complement each other [2].

Young students generally communicate and interact in social networks approaching in highly informal environment. Social networks are expected to increase the interaction related to formal educational purposes, but young people use these applications essentially in the social sphere, which does not imply that their interaction does not touch on academic issues, because one way or another they comment on these activities, achieving an educational social communication [6]. For Lim (2016) [7], the Social networking sites have played an important role in enhancing students' social presence. They are considered as educational tools for learning and teaching purposes.

Samad et al. (2019) [8] have presented a research paper, the impact of social networking sites on students' social wellbeing and academic performance, the study shows that SNS play an important role in enhancing students' social presence. As an educational tool for online courses, they have significantly contributed in promoting students' motivation for learning.

Students expect to be educated in more creative environments based on ICT tools, used in their daily lives. This requires the innovative use of formal and informal virtual platforms, which involve students in learning active [9].

Based on the presentation of these current approaches and trends of the teaching-learning process with the participation of the prevailing technologies in the daily life of the apprentices, particularly in higher education, for effective learning, it aims to unveil the following topics:

1. Identification of the current characteristics of LMS and SNS in Higher Education.
2. Analysis of the various current aspects of the technology that have been covered by different proposals for the integration of SNS in LMS in the educational field.
3. Identification of different factors that influence the integration of SNS in LMS in educational field.
4. Suggestions for future scientific research regarding synergy of SNS in LMS in higher education.

II. PARADIGMS OF THE USE OF TECHNOLOGICAL TOOLS IN HIGHER EDUCATION

Education is a complex system that requires multiple perspectives and levels of analysis to understand its contexts, dynamics, and actors' interactions, particularly concerning technological innovations [10]. The LMS and SNS and their synergy of these two tools are analyzed in order to implement the combined learning in higher education. In particular, digital tools or platforms with human-computer interaction capabilities can improve automated processes for combined modes of learning delivery. In this context, digital technologies such as video capsules and smart tutoring systems can improve teaching-learning activities. First, by providing access to more students and facilitating online learning activities at their own pace. Second, by offering an individual learning path for each student, thus improving activities and comments outside the classroom. Educational technology

capabilities provide complementary information to identify the best approach by aligning learning objectives in technology-based implementations.

It can also be mentioned that Social networking sites are powerful tools to build virtual communities that can promote more interactive, meaningful and dynamic informal learning in students [11], being able to express their emotions openly. However, technology could not be effective in education if, in its conception, cognitive competences are not considered [12,13] that promote student participation in the search of information, integration, construction of knowledge, analysis of the problem and its forms of solution. Undoubtedly, the pedagogical part, the design, organization and the way of carrying out the teaching and learning process are fundamental variables for the success of bLearning.

A. Characteristics of Learning Management Systems in Education.

Higher education institutions at the international level have seen the need to adopt and integrate information and communication technologies to meet the opportunities and challenges of innovation in teaching and learning processes. This logic has led to the implementation of virtual learning environments called 'Learning Management Systems', the functionalities of which support flexible and active learning under a constructivist approach.

Virtual training is becoming one of the most used methods of training both in its full application of e-learning or mixed with face-to-face training and b-learning in higher education. However, it is increasingly reaching other education levels [14] because of its potential to accommodate flexible, interactive, multimedia and decentralized teaching. Its technological base is supported by learning managers or 'Learning Management Systems' (LMS) [15], Moodle being one of the most used platforms internationally, and as noted by Kerimbayev, Kultan, Abdykarimova and Akramova (2017) [16], it presents a number of advantages: it works without modifications in any operating system compatible with PHP. It works as a set of modules and allows you to add or remove elements flexibly at different stages.

On this platform, teachers and students show high levels of satisfaction and technological acceptance [17], and teachers tend to perceive that its use improves educational practice and presents a wealth of advantages [18]. However, different research has been carried out that concludes that there is indeed greater use of LMS platforms but that there is no generalized evidence of a change in pedagogical practice [19], where teachers tend to use it more to transmit knowledge than to develop, invent and create knowledge. This is spurring debate in universities because they have invested economic and human resources into implementing LMS and educational practices have not changed.

B. Characteristics of Social Networking Sites in Education

Social networking sites are virtual communities that allow people to connect and interact with each other on various topics [20]. The young community, which is in the learning universe, is the largest user of the SNS. It is common to see in the classroom many young people using their mobile devices to communicate with their contacts, which by the way, in many cases, cause discomfort to their teachers. On the other hand, SNS offer advantages for students because they encourage dialogue among peers, promote the sharing of resources, facilitate collaboration and cooperation.

In the Milad's (2018) research [21], establishes the concept of "connectivism", based on the principles of "behaviorism", "cognitivism" and "constructivism", for the creation of learning environments. These theories, however, developed at a time when learning did not have the participation of technology. Nowadays it could be said that the use of SNS creates in the user an automatic cognitive system that generates motivational and behavioral impulses to participate in a rewarding behavior, where mental associations are registered between stimuli, behaviors and rewards [22].

The social networking sites have been evolving since their appearance in 1997, as illustrated in Figure 1, starting with SixDegrees that gave the characteristic of creating a profile and a list of friends [23]. In 2000 Ryze appears, that facilitates the presentation and connection to businessmen and investors around San Francisco. Tribe.net created a site with greater user integration; LinkedIn became a powerful business service that supports the labor market; Friendster became an important gaming network. MySpace appears in 2003 as an imitation of Friendster and with a focus on supporting online commerce. Mark Zuckerberg founded Facebook in 2004 as a promotion and communication program among Harvard students. Nowadays Facebook seems to be the best known and most used social network in the world. The other social networking sites that followed in 2006 and 2011 are Twitter and Google+, which have been the youngest networks so far [24].

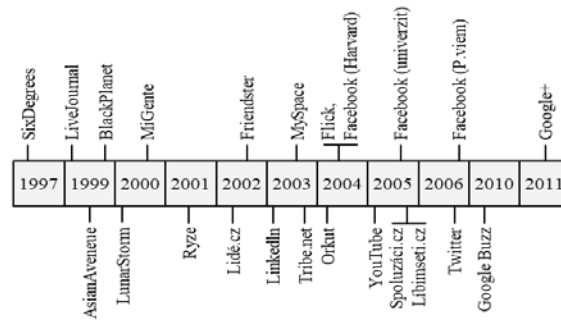


Fig. 1. The Historical Development of Social Networks [24].

Throughout the world there are a large number of social networking sites, some countries use their own networks, others prefer widely disseminated networks, however nowadays, according to Cerná & Poulová (2012) [25] and Statistics (2017) [26], the most popular networks are: Facebook (56% of users), LinkedIn (14% of users) and Twitter (11% of users). The use of social networks, as illustrated in Figure 2, continues to increase every year. In 2018, it has 2.62 billion users and its growth is estimated to continue in the following years.

Facebook is the most popular social network and the most used worldwide [27], which could be used as a very important tool for the educational field [28]. Nowadays, universities have incorporated and enhanced virtual learning environments in the educational process, such as Facebook, allowing university teaching to be a source of contextualized learning [29]. Thus, affirming that SNS in the educational context is still in the early stages, and more in-depth research is needed where the main focus lies on the integration of this tool in the teaching-learning process based on this context visualizes the impact that occurs in cognitive, social and teaching presence, being the most relevant social presence [30].

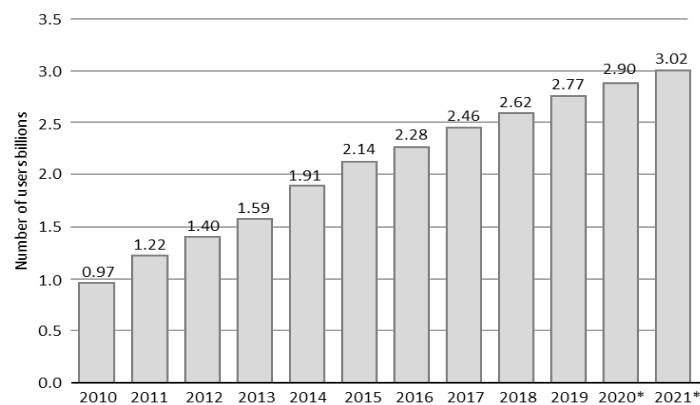


Fig. 2. Number of Users of Social Networks Worldwide [27].

C. Cognitive and Constructive Social Process in Learning

Some researchers consider that the main problem in learning is the lack of support to the cognitive and constructive social process, where knowledge is located within the process of social exchange, centered on the cognitive presence where the triggering events of the activities for exploration are presented, looking for ideas and relevant information and integration in the resolution of problems, with the use of technological resources that promote and potentiate interactions [31].

eLearning theorists employ cognitive models of learning, and cognitive computation (CC) applications use machine learning techniques to understand student behavior. CC due to its seeking to exhibit human-level abstractions of computational processes, works to add human-level meanings to the web of socio-technical phenomena, one of the reasons for being is the Web Science (WS) [32].

The technologies here do not only serve to assist learning but instead work to shape “the cognitive processes that underpin learning” [33], and with technology-use being culturally mediated “technologically mediated learning (via asynchronous learning networks) is necessarily shaped discursively by the practices around technology privileged in a particular cultural milieu”

The instructional strategies are derived from models of pedagogy or learning, the three main categories of which are behavioral, cognitivist and constructionist, each providing principles defining what it means to learn with respect to the nature of the content, the behaviors of teacher/student and the setup of the learning context that is to generate the ideal learning event. Understanding the relationship between social interaction patterns and cognitive engagement levels has critical implications on collaborative learning theory, pedagogy, and technology [34].

The social constructive is the constructivist model with the influence of the social factor. New knowledge is formed from the relationship of the person with their reality, from participation in interpersonal and intersubjective interaction [35], expressed through a common understanding language. Learning is a social process [36]. The social constructivist perspective allows teachers to locate that the learning is in the context of the extracurricular activities of the students, in their family environment.

III. INTEGRATION OF SNS IN LMS IN THE EDUCATIONAL FIELD

A combination of LMS and SNS for efficient learning in formal education requires technologies and factors that influence the educational context. In this, several researchers focus on the methods of effectiveness of digital technological tools for their adoption in the learning-teaching process.

A. *Aspects of Technology in the Integration of SNS in LMS*

In recent years, several studies have been developed for the integration of educational tools, in particular SNS and LMS in eLearning environments. Song (2011) [37] states that LMS, specifically in the pedagogical aspect – which determines the success of an LMS – are still in their infancy. It proposes, based on the study by Delone & Mclean (2003) [38], a new paradigm in education integrating the pedagogical influences in the LMS. This model considers the six dimensions: Quality of Information, Quality of the system, Quality of Services, use of system or intention of using it, User Satisfaction and Net Services. Starting from these six dimensions sheds light to an adapted model, so the use intention category is correlated for both the student and the teacher and therefore, the results of the category net benefits are favorable for teaching and learning, achieving that the student can improve his learning experience. Baker et al. (2014) [39] focus their studies on the determinants of the adoption of LMS by university teachers, building an integrative model of information systems based on the theory of confirmation of expectations (EC & IS: Expectation-Confirmation based IS); the Technology - Organization - Environment (TOE) model; models grouped under the UTAUT framework. The EC & IS has an interest in the analysis of relative technical variables of the system such as perception and behavior. The TOE includes the analysis of the variables linked to the environment of the organizations, social influence on the use of a specific LMS system. The UTAUT centers the analysis on variables linked to the subjects' sociological characteristics, such as age, gender, technological skills, etc. Ghazal et al. (2018) [40] in the study Critical factors for the acceptance and satisfaction of the bLearning learning management system, based on the conceptual framework of the IS success model, affirm that the barriers to an acceptance and satisfaction of the LMS in bLearning environments are the social interactions, administrative difficulties, academic and technical skills, time, motivation, technical difficulties and limited access to resources.

In the literature regarding the integration paradigm of the SNS, for eLearning educational environments, several works are observed, Mazman & Usluel (2010) [28], Cheung et al. (2011) [41], Du et al. (2013) [42], Chua & Choo (2013) [43], among others, where the importance of capturing the attention and academic development of students in the SNS and LMS is analyzed. For that, they perform a series of evaluations based on the parameters of each study, so: The Educational Model Using Facebook, proposed by Mazman & Usluel (2010) [28], poses a structural model of how users could use the SNS Facebook for educational purposes. This model implies adoption, purpose and educational use variables. Adoption is related to qualities of utility, ease of use, social influence, facilitating conditions and identification with the community. The variable purpose is related to social relationships, relationships with work and daily activities. In the variable of educational use, Facebook is researched into three topics: communication, collaboration and the sharing of materials and resources among the members of the environment, whether are students or teachers. This last element, facilitates the discussion in class, realization of tasks and work in groups, allows collaborative learning. In this context, the validation of the model is performed by analyzing the three (3) variables and eleven (11) constructors, revealing that the Adoption of Facebook variable was quite satisfactory, the purpose was satisfactory, while the variable of educational use showed to be very satisfactory. Making known that the tools that social networks have, such as support in the interaction for carrying out educational activities, are collaboration, active participation, the availability of information, the exchange of resources and critical thinking. Braz et al. (2013) [44] formulate an architecture based on software agents and ontologies, with the aim of promoting the integration of Moodle with different social networking sites. This architecture transmits information generated by Moodle to the SNS informing the student what happens in the course, allowing students from the SNS to interact with Moodle resources.

Cheung et al. (2011) [41] develop and empirically validate an intentional social action model in social networks, in this case why do students use Facebook? They are based on the developed "we intention" model of the theories such as: social influence (subjective norm, group norms, and social identity), the five values of use and the gratification paradigm, as well as finally the social presence, actions that are widely adopted to determine the intension of use of virtual communities [45], the results of the study show that social presence has the strongest impact on the intension of use of Facebook. This supports the fact that most people use Facebook in order to get instant communication and connection with their friends. Du et al. (2013) [42] propose a way to teach and learn by examining traditional LMS approaches in the teaching-learning process with the organization of learning material, and the inclusion of social software such as wikis, blogs, and social networking sites in general. The authors believe that the combination of these two paradigms can be an appropriate adoption by many educators to meet emerging needs in education. The students of a course connect to the interactive and collaborative e-learning platform, integrating LSM with social software, through a social network. In this modality, users can build a personalized social network considered as a knowledge network for an active, interactive and collaborative participation, improving the teaching-learning process. This model combines the process of cognitive learning with constructive, without neglecting social interaction. Another approach to integrating the social network in the virtual learning environment (VLE) is addressed by Chua & Choo (2013) [43] to state the limitations of existing VLEs against the lack of personalization, interaction, discussion, collaboration and communication; they emphasize the interaction in real time, stimulate group learning and improve the ability to share resources. As a result, they create the MyVLE platform that integrates the most popular SNS, such as Facebook, YouTube and Google Calendar, to achieve optimal interaction, maintaining a high degree of social functionality.

Peng et al. (2013) [46] project a knowledge management system to support web-based learning in higher education, with access to any digital electronic device, such as smartphone, computer and tablet. Users of that system can easily organize and share learning resources. The teacher enters the KMS, and from his individual knowledge manager (IKM) sends to the university website the didactic material of the course for the educational work of the following week. The student checks on the university website, through his access device, the course's teaching material and memorizes the key points of the next class. Another student reviews the didactic resources and searches in the KMS, entering in the IKM, interesting articles that he has read previously related to the subject, and shares those resources in the university website. The teacher reads and analyzes the articles and resources of the students, for their possible use in their KMS. If a student believes that the topic is interesting, he creates a personal folder MY RESEARCH in his IKM organized in the KMS and stores it for use in his research. By analyzing the material from the point of view of its usefulness, and uploads to the group knowledge manager (GKM) of the KMS in order to share and show all the members of the group. In a physical meeting, they discuss in a group and look for related resources in the public knowledge manager (KMP) in order to achieve a final integrating document. This scheme encourages knowledge mediated by discovery and experimentation, with the social and constructive contribution of each of the students.

Finally, in the analysis of the conceptual framework for the use and evaluation of web-based learning resources (WBLR) in school education conducted by Hadjerrouit (2010) [47], three fields are focused on: technology, pedagogy, and content. From a technological aspect, the use of web technology and internet services (HTML, URL, browsers, e-mail, as well as wikis and blogs that allow collaboration and communication activities, and multimedia) are considered. From the pedagogical aspect, the different theories such as instructionism, behaviorism, constructivism, cognitivism and collaborative learning or a combination of them are analyzed. From the content point of view, it supports the different topics of a given subject. In the application of the model, the results obtained have a positive impact on the correlation of the technological field and the ease of pedagogical use, meaning that there is a cause-effect relationship between them, which implies that the technological part could have influenced the ease of pedagogical use. Technological resources were satisfactory while the pedagogical part had a decrease in acceptability, there being two variables negatively valued in this relationship, such as collaboration and variation. All the relevant information treated is summarized in Table 2 in relation to models used in LMS, in Table 3 the models applied in SNS, in both cases in the educational context.

TABLE 1.
THEORIES / MODELS APPLIED TO LMS IN THE EDUCATIONAL CONTEXT.

| N. | Authors | Models | Approach | Variables | Dimensions | Contribution in the teaching-learning process |
|----|----------------------|---------------------------------------|----------------------------------|--------------------|--|---|
| 1 | Garrison (2000) [48] | Conceptual educational model mediated | Technological, Cognitive, Social | Cognitive presence | Triggering event, Exploration, Integration, Resolution | Conceptual model |

| | | | | | | |
|---|------------------------------------|---|-----------------------------|---|--|--|
| | | by technology (CoI) | | Social presence | Emotional expression, Open communication, Cohesion of the group, Instructional management | |
| | | | | Teacher presence | Build understanding, Direct instruction | |
| 2 | Martínez-Torres et al. (2008) [49] | Extended acceptance model of TAM | Technological | Use, intension of use, perceived utility, ease of use, methodology, accessibility, reliability, enjoyment, user adaptation, communicativeness, feedback, format, interactivity, dissemination, user tools | | Analyze the resistance of people in using technology, predicting user response for acceptance of use. Evaluation of electronic learning theories. In experience, the variable with the least impact was the ease of use, since digital native students are familiar with the use of digital tools. |
| 3 | Song (2011) [37] | Success model of DeLone and McLean adapted in LMS | Pedagogical | Quality of the information, System quality, Quality of service, User satisfaction, Use, Net Benefits | Accuracy, punctuality, reliability, integrity. | The model is not validated |
| 4 | Peng et al. (2013) [46] | Knowledge management model for web-based learning through machine learning | Technological | Creation and storage of knowledge | Catalog of courses in KMS. Creation and edition of notes | Functionality in the administration of resources in the online learning process. |
| | | | | Acquisition of knowledge | Search for knowledge Different customer | |
| | | | | Organization of knowledge | By different form By different scope | |
| | | | | Share and transfer knowledge | Group and public knowledge management | |
| 5 | Ghazal et al. (2017) [40] | Acceptance and satisfaction of LMS in bLearning environments by students | Technological | Technological experience Quality of the System, of the information, of the service. Ease of use perceived. Perceived satisfaction. Student satisfaction | | Students using questionnaires. The quality of the System as a most significant positive factor that affects the acceptance and satisfaction of students. |
| 6 | Hadjerrouit (2010) [47] | Conceptual model that explores the design and evaluation of web-based learning resources (WBLR) | Content Pedagogy Technology | Usability criteria | Technical usability: content design and form of the page. Pedagogical usability: comprehensibility, added value, orientation to the goal, time, interactivity, multimedia, motivation, flexibility, autonomy, collaboration, variation. Medium material: textbooks, IT infrastructure, curriculum, subjects. Non-material means: students, teachers, leaders. Ease of use: reliability, functionality, flexibility, portability, integration. Reliability: consistency, response, empathy, security, relevance. Intensity of use of the teacher and student. Benefits of teaching and learning. | Participation of students, professors and team of professionals in WBLR design. Impact of design and evaluation of the WBLR was the pedagogical usability and the technical usability. |

TABLE 2.
THEORIES / MODELS APPLIED TO SNS IN THE EDUCATIONAL CONTEXT

| Nº | Author(s) | Characteristics | Approach | Variables | Dimensions | Contribution in the teaching-learning process |
|----|----------------------------------|---|--------------------------|--|--|---|
| 1 | Mazman & Usluel (2010) [28] | Influential theories in adoption and technological innovation (TPB) (TRA) | Technological, Social | Adoption | Utility, ease of use, social influence, facilitating conditions. Community Identity | Students analyzed in adoption of social networks in the teaching-learning process |
| | | | | Purpose | Social relations, relationship with work, daily activity | |
| | | | | Educational use | Communication, collaboration, sharing resources and materials. | |
| 2 | Turel & Qahri-Saremi (2018) [50] | Behavior of the impulsive use of social networks | Technological, Cognitive | Emotional and cognitive in the use of an SNS | Cognitive concern, emotion, administer | Users focused on impulsive use and other SNS users focused on obligation. The strong emotional cognitive system generates reoccupation and impulses, and a weak cognitive system controls and regulates cognitions and behaviors |
| | | | | Cognitive behavior in the use of an SNS | To restrict, Concern | |
| | | | | Impulsive use of SNS | Perceived stress, gender, age, years of use of the SNS | |
| 3 | Dumpit & Fernandez (2017) [51] | Technological model of acceptance and use of modified TAM | Technological, Social | Perceived Utility. Ease of use perceived. Intensity of use, current use of the system. Subjective norm, Perceived satisfaction. Connectivity | Internet speed and reliability | Students from Philippine universities are analyzed. The perceived utility, the perceived ease of use, the subjective norm and the perceived satisfaction are predictors of the use behavior of the SNS. Institutions of higher education should regularly use social networks in the classroom. |
| 4 | Cheung et al. (2011) [41] | Elements that motivate students to use social networking sites. | Technological | Social influence, Social presence | Subjective norm, group norms, social identity | Social presence determines as a predominant factor in the use of Facebook |
| | | | | Values of use and Paradigm of bonuses | Intentional value, entertainment value, social improvement, interpersonal interconnectivity, self-discovery. | |

B. Factors that Influence the Integration of SNS and LMS in the Educational Context.

Literature reviewed involving the use of LMS and SNS technology, refers to different variables and factors, many of them within the known theories and models, for the effectiveness of the use of technological learning and teaching systems. These factors could be used in the integration of SNS and LMS in education at any level. In Table 4 the different variables for this context are explained. To analyze the validity of the content, the most relevant variables were considered, summarized in the previous section and which leads to define the variables contrasted in the study.

TABLE 3.
VARIABLES CONSIDERED IN SNS AND LMS TOOLS IN THE EDUCATIONAL CONTEXT.

| VARIABLES | DEFINITION | THEORIES / MODELS | REFERENCES |
|-----------------------|---|-------------------|---------------------------|
| Perceived utility | Degree to which a person believes that using a particular system would improve their performance. | TAM | Davis et al. (1989) [52]. |
| Perceived ease of use | The degree to which a person believes that using a particular system would be effortless | | |
| Intensity of behavior | Person who performs a conscious act and who in doing so may decide to use or not use a technology | | |
| Subjective rule | The perception in knowing what most people think should or should not perform the behavior in question | TRA | Ajzen (1985) [53]. |
| Intrinsic motivation | The perception of wanting to perform an activity without apparent reinforcement other than the process of performing the activity by itself | MM | Davis et al. (1992) [54]. |
| Extrinsic Motivation | The perception that wants to carry out an activity because it perceives a stimulus to achieve a value different from the activity itself. | | |

| | | | |
|-------------------------------|--|----------------------------------|-------------------------------------|
| User satisfaction | A user is satisfied or unsatisfied with the information system. | Information System Success | Delone & Mclean (2003) [55]. |
| Facilitating condition | Factor that the observers agree to make an act easy to perform. | | Venkatesh et al. (2003) [56]. |
| Social Factor | Individual internalization of the subjective culture of the social group of reference. | | |
| Interactivity and control | System characteristics so that a user can interact with each other and control the form and content in an environment | | Martinez-Torres et al. (2008) [49]. |
| Communication | All activity that allows communication between students and instructors. | | |
| Collaboration | Activities of union of people related to the accomplishment of group works when sharing tasks, projects, ideas, etc. | Modelo educativo | Mazman & Usluel (2010) [28]. |
| Share resources and materials | Exchange ideas and information on topics of interest, involves sharing resources, materials, projects and documents to execute the tasks. | | |
| Usability criteria | Techniques to ensure a smooth interaction with the pedagogical support software in the learning process. | WBLR | Hadjerrouit (2010) [47]. |
| Contexts of use / evaluation | Factors that influence the relationship between students and elements in the teaching-learning process, divided into material and non-material | | |
| Use | The intention of use that the student and teacher can give to the LMS depending on the net benefits and the satisfaction to generate the use. | IS Success Model – LMS bLearning | Song (2011) [37]. |
| Net benefits | The benefits obtained by teachers in teaching and by students in learning in the LMS | | |
| Social Identity | Sense of belonging of an online SNS when users see themselves as members of a community. | | |
| Social influence | Preconceived opinion of how another judge the behavior of a particular person | | Cheung et al. (2011) [41]. |
| Social presence | Continuity of groups of people using an online SNS. | | |
| Share and transfer knowledge | The exchange of knowledge between organizations. The process accumulates and refines the group's knowledge by storing new knowledge and eliminating duplication. | WEB | Peng et al. (2013) [46]. |
| Internet connection quality | The stability of the internet connection defines the quality of access to online technology, the impact of speed and the reliability of the internet connection. | TAM-SNS | Dumpit & Fernandez (2017) [51]. |
| Impulsive use of the SNS | Frequency and time of use of social networks in terms of spontaneity, impulsiveness and recklessness / speed of use | | Turel & Qahri-Saremi (2018) [50]. |
| Technological experience | A greater technological experience with LMS, greater use of technology, which defines satisfaction and technological acceptance. | | Ghazal et al. (2017) [40]. |
| Student satisfaction | Indicated by happiness and the agreement of use of the system. Measure of the success of a system as an adoption factor or not a learning system. | | |
| Quality of the System | A crucial factor for the satisfaction and acceptance of any technology by students, including LMS. | | |
| Quality of the information | Quality of the course content in LMS, including accuracy, integrity, sufficiency, accessibility, comprehensibility, punctuality and format | TAM – LMS | Ghazal et al. (2017) [40]. |
| Quality of service | Indicates the quality of support services provided to system users. They influence the acceptance and satisfaction of students using LMS. | | |
| Acceptance of students | Student acceptance can be assessed by perceived ease of use and perceived usefulness. | | |

Because of the complexity of the educational system –in the sense of varied types of courses, teaching styles, models of adopted education, involvement of people in learning-teaching, educational management, and the adopted technology and its costs– it is necessary to consider criteria and parameters of technological acceptability for the effective implementation of LMS technologies with the insertion of LMS in the educational context. From the variables used in the different approaches for the improvement of education with technology, as shown in Table 4, an appropriate set of those parameters should be used for the establishment for the adoption of educational technology. However, in reality, they are rarely evaluated in the effectiveness of learning terms, user satisfaction, pedagogical, cognitive issues, including the use of the system, user education and learning experiences are rarely taken into account. Which implies obtaining a successful tool that meets the objective for the good performance of a social LMS.

IV. DISCUSSION

Literature explores the determinants of organizational change in universities, especially the use of new technologies that allow interaction, information and communication applied to the teaching-learning process. In this context, several models emerge –either individually or integrating LMS and SNS– and are analyzed from different theoretical frameworks. Each model contemplates a part of the problem, but none of them individually offers a complete view of it.

The study reviews different models of LMS and SNS placing in relevance the factors to be considered in the integration of LMS and SNS from the technological, pedagogical, cognitive and social approaches. In the analysis followed, Song (2011) [37], mentioned; when defining his successful IS model in LMS, that "in the pedagogical field is still in its childhood"; Faced with this concept, he proposes the integration of pedagogical influences as a need to incorporate innovations in this field to support the new learning requirements [57]. Previously, Mazman & Usuel (2010) [28] had considered that the adoption of social networks, like the case of Facebook, are important in the educational field, since they capture the attention of students with the facilities of communication, collaboration and the exchange of resources in the web. However, they did not give importance to the pedagogical aspects, learning theories, and cognitive aspects in that incorporation. On the other hand, Cheung et al. (2011) [41] contrast results with the Mazman & Usuel model, where social presence is an important and attractive factor in students. Consequently, Du et al. (2013) [42], in the eLearning platform integrating social software and LMS, create a personalized social network, in which their learning is active, interactive and collaborative, and focuses on cognitive learning concepts, given due importance to social influence, contrasting with other authors such as Chua & Chou (2013) [43], which agree on the factors of discussion, collaboration and communication and social functionality. They start the concept of learning motivation by integrating into the MyVLE platform with various social networks. The university knowledge management system, created by Peng et al. (2013) [46], also integrates the discussion, collaboration, communication by computers, smartphones, organizing levels by interaction between the teacher and students, thereby encouraging research activity among students. But, in that work they did not import into the classification of the information that the student wants to know, as also the cognitive aspects of learning were not considered. Social influence helps significantly in improving eLearning, with that approach Baker et al. (2014) [39] focus their research on the grouping of several models of adoption of the LMS, similar happens with Braz et al. (2013) [44] that integrate MOODLE with social networks focusing fully on the technological scope and its increase in student participation, while Hadjerrouit (2010) [47] analyzes a conceptual framework for the evaluation of web-based learning resources assessing the technical usability and the inclusion of contents for learning and pedagogy.

The SNS integration studies in LMS combine formal with informal learning and consider that the combination of these two paradigms can be an appropriate adoption to meet emerging needs in education, highlighting active, interactive and collaborative participation, influencing the authors that social interaction allows the interaction and construction of new knowledge. Students in the digital age are considered digital natives and are used to learning in an active environment; this means that students and teachers need an interactive, collaborative, participative electronic learning environment with an easier interactivity, beyond traditional LMS. Under this analysis, the teaching-learning process combines the synergy of the SNS in LMS in the cognitive, constructive, technological and social processes. Although in the environment of interaction that the student acted, known as social learning –mediated by different social networks–, there are moments of informal learning, the challenge for the new pedagogy is to identify those moments of learning through the analysis of the micro-social interactions, from this view knowledge that is generated and how you can promote its integration with the knowledge previously acquired by the student. That is, the insertion in their cognitive scaffolds.

Understanding the relationship between social interaction and cognitive engagement is of central importance for collaborative learning theory and practice, pedagogy development and tool development.

It is possible to emphasize that the great majority of models, theories, among others, focuses on technological aspects, and that in some studies they identify the importance of a social LMS. However, the effectiveness of learning, user satisfaction, is considered very little, the importance of pedagogy, the cognitive aspect, the usability of the system, these considerations can be analyzed by means of a model that integrates the most relevant theoretical frameworks, so that it overcomes the limitations that each one of them presents individually.

V. CONCLUSIONS AND SUGGESTIONS

In the analysis of the literature involving LMS learning tools and social networks it has been shown that the process of technological adoption has evolved significantly over the years, in its different models and in different environments; they have been expanding, adapting, modifying based mainly on the behaviors or actions of their users (students and teachers, and also of society). They are determined by the rational assessment we make about the expectations or the results obtained, as well as the different opinions of the different actors on the way to perform or not the actions. It is observed that the LMS and the SNS provide a series of very important characteristics for education such as interaction, cooperation, active participation, the exchange of information and critical thinking, effectively facilitating the teaching-learning process. The synergy of these two technological tools provide students with a series of benefits such as cooperation, the exchange of resources, the strengthening of communication between the actors of the formal and informal teaching-learning process and the development of the cognitive process.

The rising social influence and the stimulation of interaction mediated by the ICT in the development of the teaching-learning process, give rise to the change in the pedagogical process and the development of the mental mechanism or cognitive processes in the way of learning and depending on the teacher. A good LMS should provide students with the support that will help them make the best decisions in their management of available resources, conjugating with social networks that are very heterogeneous and used by people of different ages, level of education, gender, condition social and language, which provides them with social construction. Teachers and students are the main users of LMS, its use and satisfaction is not only influenced by information, but also by the interaction of the actors that promote pedagogical and cognitive aspects for a good teaching-learning process.

Many studies are in a process of constant creation of technological environments to improve the teaching-learning process, and as a consequence it has forced the evolution of educational models that are aimed at adapting to technological progress. There are several studies and methods that analyze the teaching-learning process applying various influences whether it is social, pedagogical, cognitive or technology, however it has not been possible to propose a conceptual model that complements all these criteria. There is a tendency for a teaching-learning platform that should not only be the combination of the LMS facilities with the advantages of the SNS, but also go beyond integrating pedagogical and cognitive dimensions in the teaching-learning process.

Suggestions for future research

When interpreting the results of the study, attention must be paid to a series of limitations, although different adoption models of the SNS, LMS and their synergy in the eLearning and bLearning modality in education are framed in the first instance. Studies pay more attention in their technical aspects, but their pedagogical, cognitive and social effects are rarely taken into account; this is how a series of suggestions about new research are presented, which are listed below.

First Suggestion. The implementation of models with an educational approach that help the synergy of these two tools, the LMS and SNS integrating the approaches; technological, pedagogical, cognitive and social in order to obtain an environment in which there is a real balance between classroom and virtual teaching potentializing this modality.

Second Suggestion. The integration of the SNS and LMS to the extent of its use by teachers and students will influence the teaching-learning process applying new approaches such as technological, pedagogical, cognitive and social and in what will be the satisfaction of use when teaching and the students when learning. These questions remain unclear, which requires effort to analyze the relationship between these tools.

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