Implementation of an Integrated Academic Management Model with LMS in the University System

Implementación de un modelo integrado de gestión académica con LMS en el sistema universitario

在大学系统中实施与LMS的学术管理一体化模式

Внедрение интегрированной модели академического менеджмента с LMS в университетской системе

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Abstract

The quality of a country's higher education is a fundamental cornerstone for its development; this involves restructuring and self-evaluating study programs, as well as systematizing academic processes. The Universidad Católica Santo Toribio de Mogrovejo, in response to these challenges and to national quality regulations, the Sistema Nacional de Evaluación, Acreditación y Certificación de Calidad Educativa (National System of Evaluation, Accreditation and Certification of Educational Quality - SINEACE) and the Superintendencia Nacional de Educación Superior Universitaria (National Superintendency of Higher University Education - SUNEDU), made improvements in academic processes using information technology. This research shows the results of the experience of implementing an integrated academic management model using Learning Management Systems (LMS) in a university context and explains the various phases that made up this proposal. The study is applied technological research with a quantitative approach, the sample was a census, complemented by the focus group technique and the application of semi-structured interviews. The most important results indicate that: The implementation of the integrated model of the technological platforms within the Virtual Campus (Teaching-Learning System, Academic Management System and Curriculum Management System) and integration of the LMS allow evidencing the levels of achievement of the competencies of the graduate profile and the deployment of the integrated academic management system with LMS and provides significant support to the activities of the teaching-learning process at the Universidad Católica Santo Toribio de Mogrovejo (USAT).

Keywords: curriculum, educational management information systems, higher education, learning process, occupational qualifications.

Resumen

La calidad de la educación superior de un país es un pilar fundamental para su desarrollo; ello implica reestructurar y autoevaluar programas de estudios, así como sistematizar los procesos académicos. La Universidad Católica Santo Toribio de Mogrovejo, en respuesta a estos retos y a las normativas nacionales de calidad, el Sistema Nacional de Evaluación, Acreditación y Certificación de Calidad Educativa (SINEACE) y la Superintendencia Nacional de Educación Superior Universitaria (SUNEDU), incorporó mejoras en los procesos académicos con el uso de Tecnologías de la Información. La presente investigación muestra resultados de la experiencia de implementación de un modelo integrado de gestión académica con los Learning Management Systems (LMS) en un contexto universitario y se explican las diversas fases que conformaron esta propuesta. El estudio corresponde a una investigación tecnológica aplicada con enfoque cuantitativo, la muestra fue censal complementándose con la técnica focus group y la aplicación de entrevistas semiestructuradas. Los resultados más importantes indican que: La implementación del modelo integrado de las plataformas tecnológicas dentro del Campus Virtual (Sistema de Enseñanza-Aprendizaje, Sistema de Gestión Académica y Sistema de Gestión Curricular) e integración de los LMS permiten evidenciar los niveles de logro de las competencias del perfil de egreso y el despliegue del sistema integrado de gestión académica con LMS y brinda un significativo soporte a las actividades del proceso de enseñanza-aprendizaje en USAT.

Palabras clave: competencia profesional, enseñanza superior, plan de estudios, proceso de aprendizaje, sistema de información sobre la administración de la educación.

Аннотация

Качество высшего образования в стране является фундаментальной основой ее развития; это подразумевает реструктуризацию и самооценку учебных программ, а также систематизацию академических процессов. Католический университет Santo Toribio de Mogrovejo, отвечая на эти вызовы, а также на национальные правила качества, национальную систему оценки, аккредитации и сертификации качества образования и национальный надзор за высшим университетским образованием, включил усовершенствования в академические процессы с использованием информационных технологий. Это исследование показывает результаты опыта внедрения интегрированной модели академического менеджмента с системами управления обучением (LMS) в университетском контексте и объясняет различные этапы, которые составили это предложение. Исследование соответствует прикладному технологическому исследованию с количественным подходом, выборкой послужила перепись населения, дополненная методом фокус-групп и применением полуструктурированных интервью. Наиболее важные результаты показывают, что: Реализация интегрированной модели технологических платформ виртуального кампуса (система преподавания-обучения, система академического менеджмента и система управления учебными программами) и интеграция LMS позволяет подтвердить уровни достижения компетенций профиля выпускника и развертывания интегрированной системы академического менеджмента с LMS и обеспечивает значительную поддержку деятельности процесса преподавания-обучения в USAT.

Ключевые слова: высшее образование, учебная программа, учебный процесс, профессиональная компетентность, информационная система управления образованием.

摘要

一个国家的高等教育质量是其发展的根本支柱。这意味着我们需要重组和自我评估学习计划,以及将学术过程系统化。Santo Toribio de Mogrovejo天主教大学为应对这些挑战和国家质量法规,国家教育质量评估、认证和认证体系以及国家大学高等教育监管机构,通过使用信息技术改进学术流程。本研究展示了在大学环境中实施具有学习管理系统 (LMS) 的综合学术管理模型的结果,并解释了构成该提案的各个阶段。该研究采用定量方法的应用技术研究,样本通过焦点小组技术和半结构化访谈的应用进行了补充。最重要的结果表明:虚拟校园内技术平台集成模型(教与学系统、学术管理系统和课程管理系统)的实施和LMS 的融合允许展示学生能力的成就水平,LMS 系统所提供的毕业生概况和综合学术管理系统的部署为 USAT 的教学过程活动提供了重要支持。

关键词:高等教育,课程,学习过程,专业能力,教务信息系统。

Introduction

Today, traditional education models have been overtaken by new academic needs, where each student has an independent way of learning. As a result, universities seek the support of information technologies (IT) to provide solutions to these needs (Arias-Navarrete et al., 2021).

According to UNESCO (2007), technology provides universal access to education and contributes to reducing differences, improving quality, relevance and management in learning. Therefore, education cannot stay away from the evolution of ICTs; it is necessary to take advantage of connectivity resources in society and their high relation in the educational context (Báez-Pérez & Clunie-Beaufond, 2020; Cordero Guzman & Ramón Poma, 2021).

Over recent decades, new learning modalities have been established, such as online and blended, known as mixed, and it is essential for them to integrate LMS in universities. LMS (acronym for "Learning Management System") platforms are necessary resources to be included in the university pedagogical environment as a means of teaching, enhancing the technology-education relationship (Soler-Rodríguez et al., 2021). For educational organizations, there was a strong increase in the need to develop information and integrated educational environments that combine the educational function with educational management.

LMS are tools that provide opportunities to ensure the effective implementation of an innovative policy of the higher education institution (Zabolotniaia et al., 2020) due to their effective learning model that allows solving teaching problems in favor of achieving a better understanding of knowledge in students (Gunawan et al., 2020)

In order to achieve the interoperability of applications and LMS, it is necessary to know their security and infrastructure characteristics, according to the type of LMS and the internal systems that manage their teaching-learning processes in the institution. For a university, it would be significant to articulate the LMS with: i) the student registration system; ii) the academic performance registration, iii) evaluating teaching materials; iv) activating or deactivating teachers and v) managing the "seed" components of academic spaces and others (Herrera-Cubides et al., 2019).

At universities, the implementation of LMS has spread to 99%, being used by 85% of users, even registering 56% of daily use. However, despite these rates, users do not take advantage of their functionalities. Therefore, it is necessary to establish guidelines to use all the capabilities that these environments offer (Rodrigo-Cano et al., 2019).

In 2016 the Sistema Nacional de Evaluación, Acreditación y Certificación de la calidad (SINEACE) published its new "Accreditation Model for Higher University Education Study Programs" considering 34 quality standards for study programs. This generated the need to implement improvements in academic processes through the use of Information Technology (IT) in Peruvian universities. Self-evaluating processes and restructuring study programs "have emerged as priority elements to gain access to accreditation and continuous improvement" (Casas & Olivas, 2011, p. 54).

A large number of Peruvian universities claim to have a competency-based education. The Universidad Católica Santo Toribio de Mogrovejo (USAT), located in the city of Lambayeque, has been founded 25 years ago and is included among these institutions;

however, the analysis of the teaching-learning process by competencies revealed some important difficulties to be addressed, such as:

- Lack of uniform criteria in the planning and implementation of courses; divergence in the evaluation system of syllabi of the same course, failure to deliver grades to students on time; there was no organized and systematized information on the level of achievement of the competencies attained by students during their studies and upon graduation from the university.

- Lack of integration of the information available in the virtual campus that recorded the final grades of the course with the information of the virtual classroom (Moodle), which contained the record of the partial grades, showed different weightings to the evaluation system considered in the syllabus, these aspects generated inconsistency of the information of both platforms and additional operating load to the teacher, having to keep an additional record of the evaluations in Excel or in the virtual classroom grader, this exposed to calculation errors causing claims from the students.

The main objectives of the experience have been:

- Implement the integrated academic management model to support the teaching-learning process and integrate the technological platforms of the Virtual Campus with the LMS that favor the achievement levels of the competencies of the graduate profile.

- Train key and end users in the use of the new integrated academic management model.

- Have a uniform planning that allows the development of the syllabi with a competency-based approach: performance indicators, evidence and instruments aligned to a valid competency-based evaluation to achieve the graduate profile.

- Show the levels of achievement of the competencies stated in the students' graduation profile.

In view of the problems and objectives stated, there is a need to review and propose a teaching-learning system that reflects the level of achievement of the competencies of the graduate profile in all academic programs and therefore, the following research question is posed:

To what extent does proposing a model supported by the integration of academic management systems with Learning Management System - LMS help to verify the level of achievement of the competencies stated in the graduation profile of university students?

This experience responds to the problems found and the question exposed, and describes the results of the implementation of an integrated academic management model with LMS that starts in 2018 and is implemented in 2019, the detailed procedure as well as the findings are described and developed in this research.

Method

This research has a quantitative approach and is based on technological research, which according to Cegarra (2004), allows the creation of new practical applications and the improvement of processes. Likewise, the research when proposing the im-

provement of the teaching-learning processes at USAT to optimize the indicators of competence achievement uses the level of applied technological research, which according to Espinoza (2014), allows "designing technologies of immediate application in the solution of problems seeking efficiency and productivity"; the same author indicates that it is framed in the systemic research method which faces the problem in all its complexity, relating all the parts and the resulting emerging properties.

Participants

The sample was census because the experience includes all USAT academic programs.

Of the total sample, in the discovery phase, 5 focus groups were carried out with the participation of the Vice President for Academic Affairs; academic coordinator; deans of the 5 schools, and a selected group of 20 undergraduate professors who develop and apply the curriculum plans in the different academic programs, 27 people: 41% women and 59% men, whose ages range between 25 and 58 years. During the modeling and automation phases, 26 working meetings were held with the participation of the same people included in the discovery phase.

The execution phase implemented the integrated academic management system with LMS and involved a total of 305 professors from the different academic programs: 58.2% men and 41.8% women between the ages of 30 and 65, and students from all academic programs (8,656): 57% women and 43% men, between the ages of 17 and 26.

Instruments

The focus group was applied to USAT managers and allowed the collection and analysis of information in the discovery phase. This technique asked participants to respond to semi-structured interviews with questions organized according to technical issues such as: teaching-learning process, regulations related to curriculum management, curriculum plans, syllabus development, functionality of the virtual campus and virtual classroom, among other topics.
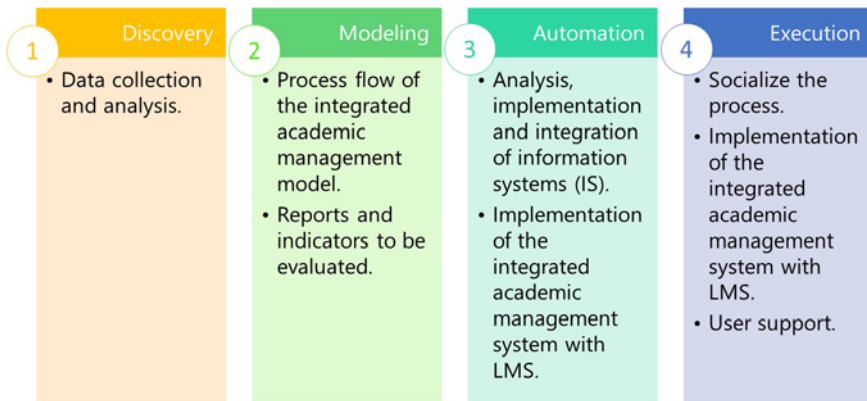
Procedure

Each participant was given an informed consent form, which was read and signed, thereby respecting ethical principles. The objectives of the research were explained, specifying that the data would be analyzed individually and its treatment would be confidential. The focus groups were held in places and times agreed upon by the research team and the participants.

A total of 26 meetings were held in the period from 2018 to 2020, the objective of which was to develop the implementation phases that consider (Figure 1): (1) Discovery; (2) Modeling; (3) Automation and; (4) Execution.

During 2018, three phases were carried out: Discovery (where information was collected and the problem to be solved was detected), modeling (the process flow and their interrelationships were designed) and automation (implementation of the academic system with LMS). In 2019, the execution phase began, which implemented the system by deploying the technical support module to deal with incidents and requests for improvement.

Figure 1

Phases for the development of the implementation of an integrated academic management model with LMS

Discovery	Modeling	Automation	Execution
1	**2**	**3**	**4**
• Data collection and analysis.	• Process flow of the integrated academic management model. • Reports and indicators to be evaluated.	• Analysis, implementation and integration of information systems (IS). • Implementation of the integrated academic management system with LMS.	• Socialize the process. • Implementation of the integrated academic management system with LMS. • User support.

Discovery phase: the focus group was applied as an instrument for information collection with the participation of the office of vice president for academic affairs (VRA); deans and professors, who have direct influence in the development and application of the curriculum plans, documents that guide the teaching-learning process of the different academic programs of USAT; likewise, a review of the general regulatory framework was carried out.

Modeling phase: Bizagi modeling software was used to design the process flow of the integrated academic management system, which includes reports of performance indicators consistent with the proposed learning outcomes, collection of evidence, instrument development and application related to expected learning, in accordance with the syllabi of the curriculum plans of the various programs. The areas of quality, office of the vice president for academic affairs and Information Technology (IT) participated in this phase.

Automation Phase: It deployed the analysis, implementation and integration of the integrated academic management system and integration with the LMS, through the following activities:

- Develop the backlog or system requirements; the Business Process Model and Notation (BPMN) was applied in the teaching-learning process and the software components that would have to be built to support the activities and interactions with external process activities were identified.

- Estimate the IT infrastructure resource capacity, based on the number of documents (files) that the system will have to generate and store in order to size the storage capacity to be allocated and test response times.

- Design the architecture carried out in three stages: (1) Architecture, identified the hardware and software components to be used as well as the technical feasibility of academic system integration implemented on a Microsoft platform with LMS that is in free software; (2) Data model: It involved analyzing the entities of the existing academic system and identifying the new entities of the teaching-learning system, and the relationship with the entities of the data model of the LMS platform, ensuring the referential integrity of the data, traceability and

query performance; (3) IS prototypes: The university has design patterns for the system interfaces that enable adequate usability, prototypes of forms, reports and indicators were developed and validated by users.

- • - Implement the technological platforms within the Virtual Campus (Teaching-Learning System, Academic Management System and Curriculum Management System) and integrate them with LMS, an aspect developed by the IT area using the Scrum framework; two teams were established, one for the development of the teaching-learning system and its integration with the existing academic system and the other for the development of the integration with LMS.

The execution phase was developed during two academic semesters:

2019-I: The main focus was to socialize the process (activities, formats, reports and indicators) with all the users involved, and to execute it manually using only spreadsheet templates as a support tool in order to: (1) make key users aware of the importance of the change; (2) validate the process by the users themselves and (3) obtain initial feedback from the users on the new process.

2019-II: The integrated academic management system with LMS was deployed to support the activities of the teaching-learning process to date.

Teams were organized to be able to deploy to all users in order to cover the necessary aspects:

- • VRA: Methodological consultant of the model
- • Quality Analysts: Consultant of the process activities, one analyst per School was appointed to be the first line of consultation during the transition.
- • Systems Analysts: consultant for the software tool, a project leader and a team of specialists were appointed to support the new platform.

The execution phase includes the transition plan (Figure 2), which focused on identifying the main stages of the deployment based on the activities of the academic schedule and aligned to the activities of the new process.

Training was given to both key users and end users and included two topics: description of the process by VRA with the support of the quality area and use of the new IT tool by the systems area.

Dissemination began with the preparation of support material (slides, videos and examples) and then the change was communicated to all users directly or indirectly involved.

The use included preparing a training environment and a real environment, configuring access to all users and conducting workshops to provide support to the user during the first experience using the tool in the real environment.
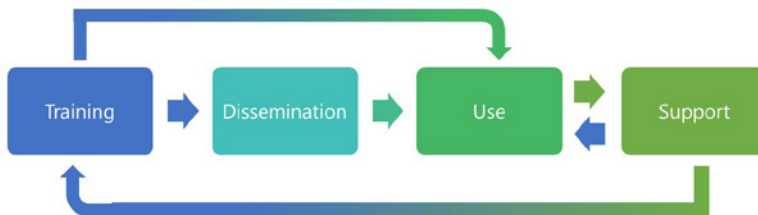
Figure 2

Transition plan for the integrated academic management model with the LMS
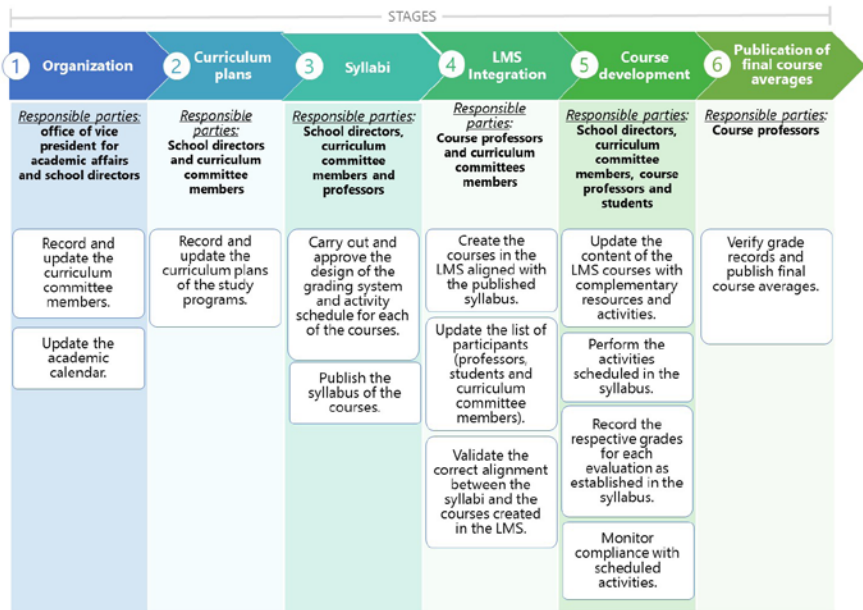
All stages of the transition plan follow the process of the execution phase shown in Figure 3.

Figure 3

Process followed in the execution phase of the integrated academic management model with the LMS

The support was carried out in two stages:

STAGE 1: It was carried out before the beginning of the semester for the activities corresponding to the design of the course, where the main users are curriculum committees and course coordinating professors. This stage had two levels of response:

- Level 01: users addressed their requests to the quality analysts designated by school, in the case of an orientation request they dealt with the question, in the case of new needs they documented them and then consolidated them and submitted them to VRA for review and analysis. If the request was not within the scope of action of the analysts, it was sent to level two.

- Level 02: two response teams were organized according to the nature of the request: (1) Academic: they were handled by VRA and its team, generally doubts about methodological aspects of the model or dispute resolution in specific aspects of each study program and (2) Technical: they were dealt with by the systems area, who were responsible for providing prompt solutions to reestablish the continuity of the operations.

STAGE 2: It was carried out during the semester for the activities corresponding to the development of the course, in this stage the main users are the course professors and the students. A three-level response flow was implemented:

- Level 01: end-user type professors sent their requests to their curriculum committees, while student queries were channeled by course professors who sent them to their curriculum committees.

- Level 02: the users of the curriculum committees of the schools addressed their requests to the quality analysts designated by school, in the case of an orientation request they dealt with the question, in the case of new needs they documented them and then consolidated them and submitted them to VRA for review and analysis. If the request was not within the scope of action of the analysts, it was sent to level three.

Level 03: two response teams were organized according to the nature of the request: (1) academic: they were handled by VRA and its team, generally doubts about methodological aspects of the model or dispute resolution in specific aspects of each study program; (2) technical: they were dealt with by the systems area, who were responsible for providing a prompt solution to reestablish the continuity of operations.

In order to examine the data, a descriptive analysis of the variables was carried out, according to the data submitted by the participants, using the SPSS® version 20 statistics program.

Results

The first result responds to the first objective set out in this research, which achieved the implementation of the integrated model of the technological platforms found within the Virtual Campus (Teaching-Learning System, Academic Management System and Curriculum Management System) and integrate them with the Learning Management System - LMS, which allowed to verify the level of achievement of the competencies of USAT graduates (Figure 4)

Figure 4

Academic management model with LMS
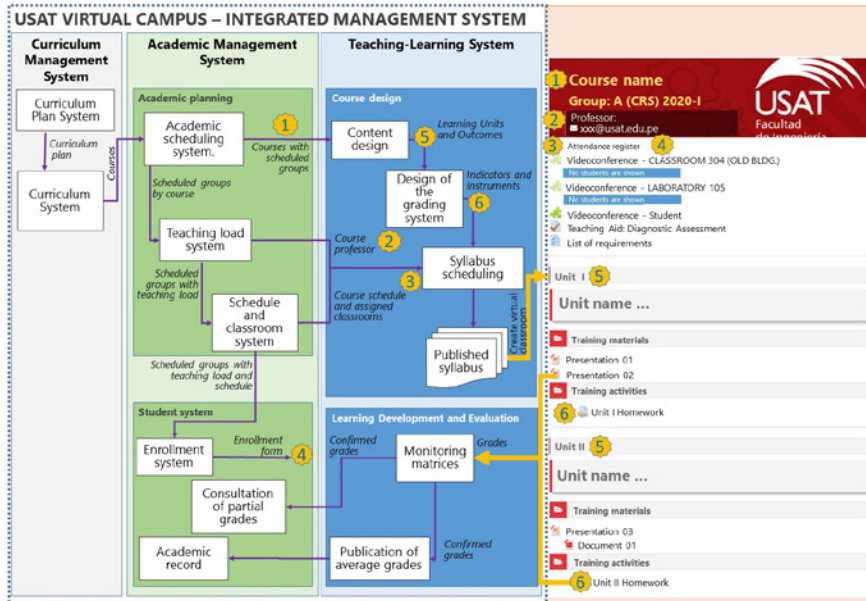
The second result allowed training key users and end users in the execution phase, allowing them to learn about the processes and use of the systems of the new integrated academic management model in which they were involved; this made it possible to meet the second objective of the research (Table 1).

Table 1

Trainings carried out during the execution phase

Date	Training topic	Number of professors trained	Groups
Jan.-Feb., 2019	Development of competency-based syllabi.	281	10 groups
Feb.-Apr.-Jul., 2019	Presentation of a worksheet to evaluate the syllabus. Learning Results Monitoring Matrices (LRMM).	223	6 groups
Nov., 2019	Use of the Teaching-Learning System. Management of indicators of the level of achievement of competencies stated in the graduate profile.	301	10 groups

The third result obtained is the design and updating of the course corresponding to the modeling phase, which made it possible to standardize the syllabi with an approach aimed at developing competencies (performance indicators, evidence and in-

struments), showing a high level of compliance in the teaching-learning system (Table 2). This result responds to the third objective of the research.

Table 2

Percentage of compliance with the generated syllabi incorporating the design and updating of courses (year 2020)

School	Total number of syllabi	Number of syllabi published on time	Compliance %
Business Sciences	336	333	99%
Law	164	160	98%
Humanities	162	161	99%
Engineering	476	473	99%
Medicine	180	140	78%
TOTAL	1.318	1.267	96%

The last result achieved responds to the fourth and last objective set out in the research, which was to obtain reliable and progressive reports from the integrated academic management system every semester on the levels of achievement of the students' competencies in their education process, which were reported in the periods that appear in the syllabi of the courses in all semesters (Table 3).

Table 3

Percentage of the levels of achievement of students' competencies (year 2020)

School	Academic Program	2020-I	2020-II
Business Sciences	Business Sciences	94.02%	89.28%
	Hospitality and Tourism Services Management	96.20%	97.50%
	Accounting	91.91%	92.48%
	Economics	94.29%	91.56%
Law	Law	94.80%	92.90%
Humanities	Communication	94.36%	93.19%
	Early Education	96.75%	97.43%
	Primary Education	97.52%	100.00%
	Secondary Education: Philosophy and Theology Secondary Education: Language and Literature	97.63%	94.72%
	Secondary Education: Language and Literature	92.57%	97.73%

School	Academic Program	2020-I	2020-II
Engineering	Architecture	86.24%	80.34%
	Civil and Environmental Engineering	86.67%	79.86%
	Systems Engineering and Computing	80.95%	81.25%
	Industrial Engineering	88.96%	88.34%
	Mechanical and Electrical Engineering	94.10%	93.90%
Medicine	Nursing	96.75%	95.70%
	Human Medicine	96.47%	98.10%
	Dentistry	98.77%	98.26%
	Psychology	97.18%	92.24%

Discussion

This experience highlights, among its most important results, the implementation of an integrated academic management model with LMS (Learning Management Systems) that has helped to verify the level of achievement of students' competencies through progressive reports, reported in the periods made in the syllabi during the semester development of the various courses of the USAT Academic Programs, a finding that is related to the studies of Juárez et al. (2020) and Wong-Fajardo et al. (2021) who quantitatively determined the academic efficiency using the LMS and indicated that higher education institutions greatly benefit from the implementation of LMS; in this same line, Marks et al. (2016) show another experience that extends in six USA universities, where they use the capabilities available in the LMS to collect data and measure student performance, generating alert and early warning systems; likewise, Pro Chereguini and Ponce (2021) evaluated the achievement of competencies in students of Spanish universities through the systematized model proposal, managing to identify less developed aspects allowing self-assessment.

Likewise, other complementary scientific studies evidence a relationship between satisfaction and benefits in students when using LMS (Ramirez-Correa et al., 2017, Ikhsan et al., 2021, Jinkyung et al., 2021) and propose strategies to help institutions make more effective use of their LMS to achieve impact on teaching and learning at universities [Adzharuddin & Ling (2013) and Mtebe (2015)], such studies are related to one of the results of the experience at USAT, which indicates that the integrated system allowed obtaining reliable results reports every semester on the levels of achievement of students' competencies in their education process, helping to monitor and make decisions for improvement as a quality university institution. In this regard, Falileeva and Shakirova (2021), in their experience of implementing adaptive learning with LMS Moodle in a Russian university, show similar results, which prove the effectiveness of the adaptive learning model in the mathematics course for students with different levels of education; Gunawan et al. (2020) evidence that the use of LMS had a positive impact on students' understanding of mechanics concepts; and Pinilla et al. (2022), in their preliminary results of implementing a LMS prototype, in the context of undergraduate clinical education, indicate increased student satisfaction in supporting self-regulated learning activities.

This same USAT finding is related to what is maintained by Ayub et al. (2010), Adzha-ruddin and Ling (2013) and Almrashdeh et al. (2011), who state that the LMS help in the planning, implementation, distribution, management and evaluation of a specific learning process. In this line of results, Juarez et al. (2020) quantitatively show the academic efficiency using the LMS.

On the other hand, universities have academic systems, usually custom-developed, in which they manage their academic planning (programming, schedules and teaching load), enrollment, grade records (academic record, honor rolls), until the graduation of their students and according to Herrera-Cubides et al. (2019), it is important to articulate the applications used by the institution in the learning process with the LMS; in addition, Ayub et al. (2010) indicates that the systems should be designed in an easy way so that users do not have difficulties when using it, findings that are related to the first result of this research that has achieved the implementation of the integrated model and its articulation with the LMS, which allowed verifying the entire academic record, recording the students' grades and evidencing the level of achievement of USAT students' competencies.

According to Barra et al. (2019), in order to achieve graduate competencies, it is necessary to adopt a self-assessment model that includes the criteria of the accrediting agency; associate the graduate competencies with each course. This aspect was taken into account in the evaluation and analysis on the problems of the teaching-learning process by competencies in USAT, which were aligned in light of the standards of the SINEACE quality model, taken into account for the proposal of this experience.

Likewise, one of the results of this study evidenced the importance of standardizing the syllabus planning that is consistent with an approach aimed at developing competencies and incorporating, in the evaluation systems, criteria such as: performance indicators consistent with the proposed learning outcomes, collection of evidence, development and application of instruments related to the expected learning and the need for all professors to work the same syllabus per course, a finding that is related to what was raised by Bezanilla and Arrans (2016) who support "a competency-based evaluation model in their proposal, which establishes how to evaluate competencies, what techniques and activities will be used, as well as how to establish the grade, assigning a percentage or weight to each competence and indicator, according to their relative importance in the learning process"; moreover, Morze et al. (2020) indicate that it is important to provide the professor with tools at all stages of the learning process that begins with the information delivery and ends with the evaluation.

One of the objectives of the study was to train end users in using the new integrated model, which is a key factor for the successful implementation of the integrated system; on the other hand, although competency-based education is not a recent topic, Larrain and Gonzalez (2007) mention that the trends of change indicate a different scenario and major transformations for the university, as represented by this proposal and its implementation, as shown in the results presented in Table 1.

Conclusions

- It was possible to implement the integrated model of the technological platforms within the Virtual Campus (Teaching-Learning System, Academic Management System and Curriculum Management System) and integrate them with the

Learning Management System - LMS, which made it possible to verify the level of achievement of USAT graduates' competencies.

- The training sessions (301), divided into 10 groups, allowed key and end users to learn about the processes and use of the systems in which they were involved.

- The process: design and updating of the course made it possible to standardize the syllabi with a focus aimed at developing competencies, evidencing 96% compliance in the teaching-learning system.

- The semester reports of the integrated system showed a high level of achievement; more than 80% of the students' competencies during their training process were met.

Some complementary conclusions considered in this proposal are summarized as follows:

In the first phase of Discovery, the importance of having an orderly institutional regulatory framework and the preeminence of integrating the participants who have a direct impact on the teaching and learning process (VRA and school directors) became evident. The Modeling phase, which incorporated the design of the process flow of the integrated academic management system, made it possible to obtain reports of achievement indicators for students' competencies in all academic programs. On the other hand, Automation was the third phase, through the analysis and deployment of four complex activities, achieved the implementation and integration of the integrated academic management system and integration with the LMS. Finally, the fourth and last phase of Execution included training, dissemination, use and support and the integrated academic management system was here deployed with LMS that supports the activities of the teaching-learning process from 2019 to present.

During the transition period towards the implementation of the integrated model there were some limitations such as lack of knowledge of the process by the end users and resistance to change; therefore, during this period, meetings were held and close support was provided to the various user groups, which should be taken into account in future research to optimize the results in similar experiences.

On the other hand, Momani (2021) maintains that choosing the most appropriate LMS that adapts to the needs and requirements of the professor and the student is one of the thorniest decisions for any educational institution, and in the future, USAT's experience could be taken as a reference because the integration of the academic management model has been a proposal that provided the expected results (Figure 3 and Table 3).

Finally, the experience gained contributed to meeting the emerging needs of the problem; however, as with any system, it is open to adjustments or adaptations arising from the use of the integrated model.

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