

Title: A Systematic Analysis of Learning Analytics using Multi-source Data in the Context of Spain

Authors: Pedro J. Muñoz-Merino¹ (<https://orcid.org/0000-0002-2552-4674>), Pedro Manuel Moreno-Marcos¹ (<https://orcid.org/0000-0003-0835-1414>), Aarón Rubio-Fernández¹ (<https://orcid.org/0000-0002-8939-9606>), Yi-Shan Tsai² (<https://orcid.org/0000-0001-8967-5327>), Dragan Gašević² (<https://orcid.org/0000-0001-9265-1908>) and Carlos Delgado Kloos¹ (<https://orcid.org/0000-0003-4093-3705>)

Abstract

Learning analytics (LA) employs educational data to improve the timeliness of support for learners. Apart from technical aspects, there is a need to understand social complexities brought about by different stakeholders, so as to systematize the adoption of LA in Higher Education (HE). We present an analysis of the situation, needs and challenges of LA in the context of Spanish HE, considering managers', teachers' and students' perspectives. Qualitative research is employed using recursive abstraction. Results reveal that the level of institutional adoption is low and none of the analyzed institutions had a LA policy. Furthermore, only two of these institutions had an initial LA strategy.

¹ pedmume@it.uc3m.es, pemoreno@it.uc3m.es, aarubio@it.uc3m.es, cdk@it.uc3m.es, Department of Telematics Engineering, Universidad Carlos III de Madrid, Avenida de la Universidad, 30, Leganés, Spain

² yi-shan.tsai@ed.ac.uk, dragan.gasevic@ed.ac.uk, Centre for Research in Digital Education, The University of Edinburgh, Moray House School of Education, United Kingdom

Corresponding Autor: Aarón Rubio-Fernández {aarubiof@it.uc3m.es}

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While the institutions shared some commonalities in their objectives for LA, chosen tools, and adoption challenges, the distinct differences in the political contexts and institutional practices among the institutions reaffirmed that LA solutions and services cannot be implemented in the same manner. Moreover, different needs for LA and concerns are identified about its adoption among managers, students and teachers. These observations lead to our conclusion that the main challenges to implement LA in Spain are not related to technological issues but to the social and cultural issues rooted in institutions and associated with different stakeholders.

Keywords

Higher Education, learning analytics, stakeholders' perspectives, systematic analysis

Introduction

Learning analytics (LA) has emerged as a science to understand and improve teaching and learning processes (Siemens, 2013). Educational data are collected, transformed and analyzed in order to inform interventions. There are different applications of LA (Bienkowski, Feng & Means, 2012): modeling user behavior, creating user profiles, modelling knowledge domains, trend analysis, and personalization. LA as a field has made much progress in terms of research in the past few years. There are robust LA applications for adaptive learning (Mavroudi, Giannakos, & Krogstie, 2018), feedback generation (Wong, 2018), or raising awareness using dashboards (Klerkx, Verbert & Duval, 2017). However, research in institutional adoption of LA tools and examples of best practice are only a handful (Tsai, et al., 2018a), (Colvin et al., 2017), (Macfadyen, 2012), (Dawson et al., 2018).

In the context of Spain, there is a general awareness of the importance of LA among Spanish Higher Education Institutions (HEIs). SNOLA (Spanish Network of Learning Analytics, <https://snola.es/>) has

been set up as a result to facilitate collaborations among universities and researchers. However, as far as we know, there has not been any research that systematically investigates the situation, needs and challenges of LA in Spanish Higher Education taking into account managers', teachers' and students' perspectives. This is relevant to better understand the steps taken towards the adoption of LA and the main challenges within this country. A review of LA policies around the world (Tsai & Gašević, 2017) revealed that adoption of LA is immature and identified several challenges for this adoption apart from technical issues, including leadership capabilities, shortage of equal engagement among stakeholders, shortage of pedagogies, insufficient training opportunities for relevant users of LA, low number of validated examples of the impact of interventions, and low number of LA policies. The situation in different contexts varies given that LA is susceptible to cultural differences (e.g., differences in the perception of the value of data, resistance to the use of new technologies, etc.) (Greller & Drachler, 2012), (Oster et al., 2016). While previous research provides some insights about the possible challenges when adopting LA at global level, they do not reflect the specific situation in Spain. The analysis of LA in specific regions is also important due to the aforementioned cultural differences, and contributes to have a better perspective to the state of the art of LA adoption. To the best of our knowledge, there are no studies about the adoption of LA in Spain that focus on aspects such as the level of adoption, challenges that hinder the adoption of LA, or the elements to be included in a LA policy. In addition, few studies have combined and taken into account the perspectives from different stakeholders (managers, students or teachers) about the adoption of LA to understand their common interests, concerns, or discrepancies in the perceptions of LA. It is important to analyze these perspectives to cultivate shared vision and co-ownership of LA.

In this work, we analyze several aspects of the adoption of LA in the context of Spain, including the main objectives, the adopted or desired tools, privacy and ethical issues, and other LA policy aspects.

Taking this into account, this article aims to address the following research question:

- What is the situation, needs and challenges of LA in the context of Spanish higher education, and based on the opinion of different stakeholders?

In order to address this research question, the following specific objectives are proposed, which are organized in different categories to facilitate reading and understanding.

1. Level of adoption: Analyze the level of adoption of LA in Spain and the level of adoption of policies for LA.
2. Objectives and goals: Document the objectives and goals of LA in Spain for managers, teachers and students and where they match or diverge.
3. Learning Analytics Tools and Services: Describe the main LA tools that are in use in Spain for several institutions and the tools that teachers and students would like to use.
4. Ethics and privacy: Document the main ethical and privacy issues of LA in Spain from the perspective of managers, teachers and students.
5. Other Policy Aspects: Describe the main LA policy issues in Spain from the perspective of managers. For this question, we only present the point of view of managers since they tend to have a more active participation in policy formation and delivery than students and teachers.
6. Challenges: Identify the main challenges that hinder the adoption of LA in Spanish institutions.

Addressing these research objectives will contribute to guide the future direction of LA adoption in higher education in general, and especially in the context of Spain. In order to address these challenges,

qualitative analyses are carried out based on interviews with senior managers and experts, and focus groups with teachers and students.

Related Work

The adoption of LA at institutional level can be hard to achieve since there are many aspects to be considered in the adoption (e.g., policies, objectives, ethics and privacy, different stakeholders' perspectives, etc.), and institutions often find many barriers that make it difficult to address all those aspects. Understanding the aspects for the adoption of LA and the possible barriers can help institutions towards the adoption. The objective of this section is to review some aspects of LA adoption.

Level of Adoption and LA policies

The degree of adoption of LA at institutional level is not high (Tsai & Gašević, 2017). An specific analysis of different European institutions revealed a low level of adoption of LA in general in Europe (Tsai et al., 2020). Despite the fact that there are many approaches to apply LA at a small scale level, there is a need to evolve from these small scale solutions into large scale ones (Arnold et al., 2014). However, it is problematic to implement LA solutions at large scale (Dawson et al., 2018). There are many considerations to take into account for the adoption of LA at large scale such as ethics and privacy, setting up the institutional goals that address needs of relevant stakeholders (which can involve students, teachers, institutional leaders and/or managers, policy makers, LA researchers, and supporting staff, among others), select the proper tools or evaluate their progress and impact. Some approaches have tried to suggest steps to facilitate the adoption of LA. For example, the use of complexity leadership theory is advocated to overcome challenges in a complex adaptive system (Dawson et al., 2018), the SHEILA policy framework as guidelines for the development of LA policies and strategy (Tsai et al., 2018b) or the LALA framework as a combination of four dimensions (institutional,

technical, ethical and communal) to try to facilitate adoption of LA in Latin American institutions (Pérez-Sanagustín et al., 2019). For example, the SHEILA framework has been applied for developing a policy at large scale (Hainey, Green, & Gould, 2018). There are also other more general solutions for the adoption of learning technology and not only LA (Mabhele, & Van Belle, 2019). Therefore, current adoption of LA is low although there have been several initiatives to support the creation of policies and the adoption of LA.

Challenges

There are different barriers for effective adoption of LA. Some of these barriers are technical (Arroway et al., 2016), i.e., they are related to the infrastructure to handle and store data, capabilities to analyze and understand data. However, there are also issues related to addressing the adoption of LA when defining a strategy or policy (Tsai & Gašević, 2017). Among those issues, which are also mentioned at the beginning of the paper (Tsai & Gašević, 2017), there can be problems to find a proper leadership structure that support the adoption of LA, there is a lack of equal engagement among stakeholders (e.g., some stakeholders may be reluctant to the use of LA), there can be a shortage of pedagogies that support the results of LA, insufficient training opportunities for new users of LA, low number of validated examples of the impact of interventions, and low number of LA policies to guide the adoption process. Because of that, it is relevant to define a proper LA strategy and discuss how to solve the aforementioned challenges, which can limit the potential use of LA.

Objectives, Goals and LA tools

For the adoption of LA, institutions should know their objectives. By far, LA has been adopted most commonly to achieve the following objectives (Chatti et al., 2013): monitoring and analysis, prediction and intervention, tutoring and mentoring, assessment and feedback, adaptation, personalization and recommendation, or reflection. In addition, different LA tools and services can be designed and implemented to achieve these objectives. The tools can be classified depending on the data that are used for the analysis (which systems), the stakeholders that are involved, the objectives and the techniques used (Atif et al., 2013) (note that a LA tool can be used to achieve more than one objective). Therefore, in the process of LA planning, it is important that institutions define the aim of using LA and the tools and services they want to provide, so that the development is aligned to those objectives.

Ethics and Privacy

A crucial issue that affects the adoption of LA is related to privacy and ethics. We understand ethics in LA in a wide sense as all the moral implications of the use of data for education. The importance of ethics in LA is mainly focused on the collection, use and reporting about educational data. Data privacy can be seen as one key aspect of ethics. Some prominent concerns are related to anonymization, transparency, informed consent, or opt-out options. Previous works dealt with the different problems about ethics and privacy and give some principles and guidelines to tackle them (Pardo & Siemens, 2014; Drachsler & Greller; 2016; Rubel, & Jones, 2016) including aspects such as students autonomy, the rights of the users, clear explanations of the objectives, enable consent and anonymization or technical infrastructure to guarantee privacy. However, there are different aspects related to ethics in LA

where previous work has failed and additional practical approaches are needed (Kitto, & Knight, 2019). Therefore, further work is needed on ethics and privacy issues, and institutions should have specific discussions on this topic to ensure that LA systems do not compromise students' privacy and stakeholders are not reluctant to use them because of these possible issues.

Stakeholders expectations

Apart from the aforementioned aspects related to the objectives of this paper, for the adoption of e-learning systems, stakeholder expectations and in particular students' expectations are crucial (King & Boyatt, 2015). In general, the involvement of stakeholders is important in applications where user experience is critical and in the adoption of technologies (Kamal et al., 2011; Voinov and Bousquet, 2010). This involvement is also relevant in LA (Ferguson et al., 2015), where the establishment of communication channels among stakeholders in institutions is important (Tsai & Gašević, 2017), so the combination of the points of view of different stakeholders regarding learning analytics can be of benefit. In addition, more effort is needed to move from the specific small scale LA solutions to the general large scale ones (Dawson et al., 2018). Needs and expectations of stakeholders can be taken with different instruments such as interviews and can be seen as perspectives from small scale and when they are taken into account, this bottom-up approach can be covered. Therefore, it is not unusual that stakeholders' perspectives are taken into account for defining the objectives in different frameworks that are based on ROMA (Rapid Outcome Mapping Approach). It is an approach that defines a set of steps to promote policy changes in organizations) (Young & Mendizabel, 2009) such as in (Tsai et al., 2018c), (Ferguson et al., 2015). In addition, data culture and stakeholders have a crucial role for defining ethical and privacy aspects (Pardo & Siemens, 2014). Moreover, student expectations regarding LA have been analyzed (Schumacher, & Ifenthaler, 2018) or their sensemaking about specific

interventions (Klein et al., 2019a). There are also recent studies about the challenges that users envision regarding LA (Klein et al., 2019b) which also emphasizes the importance of these perspectives for determining the challenges.

Connection with previous work

Although previous works analyzed the possible objectives, tools, challenges, expectations privacy and ethical issues related to LA, they usually focus on just one type of stakeholder and on some specific issues but it is important to take different stakeholders' perspectives into account (King & Boyatt, 2015), (Ferguson et al., 2015) and different issues to analyze their priorities and needs, so as to ensure that LA meets the needs of users (Tsai & Gašević, 2017), (Drachsler & Greller, 2016), (Tsai & Gašević, 2018b). In addition, it is important to check if the priorities and needs of different stakeholders (managers, teachers and students) align with or they diverge from each other, because if they align then institutions can try to meet their expectations but if they diverge then a critical analysis should be done to make a tradeoff. In this paper, we focus on the context of Spain with the aim that the insights gained in this region will contribute to our understanding of research and practice in institutional adoption of LA.

It is also important to analyze the specific cultural differences. As far as we know, there are not studies about adoption of LA in Spain. The SNOLA network in Spain about LA, which can be considered as a stakeholder, has the institutional adoption as one of the important topics, and activities such as round tables have recently taken place. There are previous works in other regions such as an analysis of 8 different policies being most of them generic frameworks but also including cases from UK (Tsai & Gašević, 2017), analysis in institutions from UK and Australia (Ferguson et al., 2015) or analysis about

the challenges of LA using focus groups in a specific large public university (Klein et al., 2019b). It is interesting to report and analyze the situation in Spain with its particularities. For example, Spain had a specific Data Protection Law (LOPD) that ensures the right of users to be informed, but also the right of users to access, modify and delete their own data. This law has been adapted according to the GDPR European law (Regulation, 2016). While neither LOPD nor GDPR were developed specifically for higher education, the collection of educational data in Spain must comply with them.

In a previous work (Tsai et al., 2020), there is an analysis of the adoption experience, motivations, strategy or barriers for the adoption of LA in several HEIs of Europe. Indeed, the same data from interviews is used for Spanish institutions as the one used in that work. However, that work used a different methodology, included the results of a survey and was not focused on analyzing in more detail the specific situation of Spain. In addition, this work includes teachers' and students' perspectives in Spain, which was not included in (Tsai et al., 2020).

Methodology

Participants, methods and instruments

We involve three different types of stakeholders in this research, which are: 1) managers (including vice-chancellors, heads of units and LA research leaders); 2) teachers, and 3) students.

The methodology of this work was based on a qualitative analysis approach, specifically using recursive abstraction (Polkinghorne, M. & Arnold, A., 2014). Interviews were used to understand manager perspectives and focus groups were used to understand perspectives of students and teachers. Focus groups were selected for students and teachers so that they can share their experience with their peers

and it could be quite useful for the participants to encourage or inspire each other during the group conversation. However, the information that we collected from managers was less about their personal experience, but more about their operational knowledge of the institution, so focus group is not necessarily a good approach for these stakeholders because we do not need to encourage discussion. The collected qualitative data can be richer than e.g. a quantitative survey approach in the sense that qualitative approach allows certain flexibility for the research participant to drive conversation and allow (unexpected) themes to emerge from the data at the analysis stage.

Managers' inputs are used for all the aspects of this research, which are listed in the introduction section. Students and teachers' perspectives are used for knowing their objectives, main required LA tools and services and ethical and privacy issues. We do not consider students and teachers for the rest of the aspects as they are more linked to policy or strategy, which is more connected to managers.

The interviews involved 18 managers from 11 different Spanish institutions, and they took place between 2016 and 2017 (with an average duration of about 25 minutes for each interview). Different stakeholders of institutions participating in some relevant networks in Spain were contacted to ask the participation in the study and the ones that were willing to participate were selected. Stakeholders from around 20 different institutions were contacted and stakeholders from 11 different institutions were willing to participate. Some cases, several participants were from the same institution. All interviews were audio recorded. All the 11 institutions expressed interest in LA and were involved in research in LA. Among these institutions, there were 2 private institutions and 9 public ones, 9 face-to-face and 2 distance education institutions, and young and old institutions. The participant managers included vice-chancellors, heads of units, people in charge of development at ICT (Information and Communication

Technologies) centers, and research leaders in LA in the institutions. The participants were selected based on their knowledge of the state of LA in their own institutions (e.g., some participants were known as active in LA because they were part of a network or they had contributed to the community; others were contacted by the former people as they could contribute further). In some cases, multiple participants from the same institution were invited due to the fact that each person own a different piece of information regarding the adoption of LA.

The focus groups for teachers and students were carried out in one Spanish institution during 2017. Due to the difficulty to collect this type of data, just teachers and students from one institution were selected. Five students focus groups were carried out, involving a total number of twenty-three students. There were master students and undergraduate students. The age of students ranged from 18 to 25 years old. Four staff focus groups were conducted, involving sixteen teachers in total. In the selection, we aimed to have representatives from different backgrounds, and we achieved to have students' and teachers' participants from Engineering, Humanities and Social Sciences backgrounds. The duration of each focus group was between 40 and 60 minutes.

The interviews with managers contained 10 questions that enabled us to retrieve information about the abovementioned aspects. The questions of the interview can be found at the "Data Availability" section. For each of the objectives, some interview questions were identified to be more suitable to retrieve information but depending on the answers of the interviewees, other interview questions might also provide useful information. In addition, we also used our knowledge of the institution or we searched into web pages for additional information in order to complement the results to address the different aforementioned aspects. With the information collected from each institution we used qualitative

research using recursive abstraction making summaries in a hierarchical way, , i.e. first a summary for each institution (in some cases with different interviewees for the same institution), and then the grouping of similar answers from different institutions according to each of our research objective. Coding was not used for this research.

The student focus groups contained 10 questions, while the teachers' focus groups also contained 10 questions and both of them can be found at the "Data Availability" section. The answers to these questions were analyzed to address our objectives. As with the interviews, we used recursive abstraction with hierarchical analysis summaries to get a summary of the students and teachers' perspectives for addressing our objectives.

Finally, we compare the different points of view of managers, students and teachers regarding the different issues of this research to see similarities and differences among these stakeholders. In this paper, we indicate the speaker of each statement by anonymizing the names of the interviewees, being e.g. S1 for Student 1, T1 for teacher 1 and M1 for manager 1.

Considerations

This subsection presents the considerations taken into account when analyzing the data for different objectives.

Regarding the level of adoption, we consider that an institution has an institutional project of LA when it is led by the whole university (e.g., by the competent vice chancellor) but not by a specific research group or department. In addition, the project should provide service or functionality that can be used by

stakeholders from different departments or services in the institution. That is to say, the service should not be restricted to specific teaching or research departments or groups. However, this does not imply that the project has to be used by most of the employees of the organization. An institution might have an institutional project, but the services might be used by just a small number of people. However, institutional projects usually have the potential to enable the use of the services throughout the institution.

Regarding LA policies, we consider a LA policy as a set of agreements, rules or strategies in an institution to implement LA in a given institution. An institution could have a LA policy without having a LA project at an institutional level, or they could have an institutional project without a LA policy.

Regarding LA objectives and goals, related to managers' perspectives we consider the ones related to the LA projects that are in use, at the institutional level or at research level, while related to students and teachers, we consider the ones desired by them.

Regarding LA tools and services, we do not only analyze the ones that have been used by the 11 institutions according to the managers' answers but also the desired ones by teachers and students. A few of these tools mentioned by managers were implemented at an institutional level while others were used for research purposes. We compare these tools and services with the ones desired by students and teachers in the discussion section.

Regarding privacy and ethics, a priority is included if at least one member of the institution stated it as a priority. This way, we highlight the main concerns in Spanish institutions regarding privacy and ethics.

It is important to note that these are the items that managers answer in the interview. although the questions did not ask explicitly about them (they were open to discussion).

Finally, it is important to note that despite the fact managers shared their opinions about essential features that a LA policy should have, focus group questions for teachers and students did not include reflections about elements in a LA policy because the focus group questions focused on exploring their needs and concerns.

Results

This section provides the results of the analyses related to the objectives stated in Section 1. In order to address these objectives, this section is organized in six subsections, titled with the name of the category related to each objective: 1) level of adoption, 2) objectives and goals, 3) learning analytics tools and services, 4) ethics and privacy, 5) other policy aspects, and 6) challenges.

Level of Adoption

According to the established considerations, only 4 out of 11 Spanish institutions had one or more institutional LA projects. Among those projects, only one of them was widely used in their institution (i.e., by most of the teachers). This was a project that tracks teaching activities and provide some metrics about how teachers interacted with learning platforms. The LA functionality of this project was restricted to some metrics used to evaluate teachers and the project did not involve students. The other three projects were not widely used. Two of them provided raw data for interested teachers and researchers integrating data from different sources (e.g., students' interactions with different online platforms, academic data from the registration system, etc.) but did not provide higher level

information. Only one project provided teachers and students with several LA tools and services such as information about video-viewing activities on the learning platform. However, this project is not on the primary Learning Management System platform of the university and only teachers who enroll in a program can have an instance in that platform and use the LA facilities.

The results showed that none of the 11 institutions had a complete LA policy. All of them had generic rules guarding ethics and security of data practices (usually not developed specifically for LA) according to the Spanish and European laws. In addition, only two institutions have defined initial strategies for LA.

Objectives and Goals

Regarding managers' points of view, 6 of the institutions had a common objective to use LA to improve education, particularly teaching and learning processes. The other institutions did not explicitly comment on this aspect during the interviews.

Two institutions focused on improving the activity of teachers based on the own data about teachers' interactions. Teachers would receive data about their activity in their learning platforms, such as the number of accesses to different resources or the number of posts in forums, and they can use this information to improve their teaching activities. Three institutions focused on alert features, such as dropout analysis at the academic level. The data might be used to detect e.g. students at risk and take proper actions to try to mitigate students' dropout. Seven other institutions were focused on the improvement of degrees and courses, so that LA can be used to gain insights about the courses and their materials or identifying subjects with problems. In addition, other objectives that were mentioned by

two managers each one related to the on-going projects were the use of dashboards to provide students and teachers with relevant information about (e.g., their performance) or the provision of automatic feedback for students.

Regarding students' perspectives, the students also agreed on the need of LA for improving education and on the following specific points: improving teachers' activities based on teachers' data, improving the courses and materials, providing dashboards, and automatic feedback for students. In addition, students pointed out the need of adaptation and personalization. For example, some students pointed out:

S1: "I would like to think that in a few years we will have a more personalized education for people"

S2: "... you should adapt a little the class sessions to the pace of that group"

Regarding teachers' perspectives, they also agreed on improving teachers' methodologies about how they teach based on data (but with some premises, e.g., not using it for evaluation as some indicators), providing dashboards, feedback and personalization. As examples, there were different quotes from teachers towards adaptation and personalization:

T1: "... I would like to be able to offer more teaching support, but I would like to do it in a more personalized way, but we cannot do it because of lack of time and lack of skills" (lack of time is because workload of teachers is too busy to add new tasks).

T2: "... Also for personalization, because if you have a platform and you can monitor what is doing anyone, because anyone learns in a different way. Then, there can be different profiles ... And then it can justify its use"

Learning Analytics Tools and Services

All the considered LA tools and services used in-house developments instead of commercial solutions. Commercial solutions did not adapt to the needs of the institutions in these cases. We can differentiate five types of tools in use in these institutions: 1) reports with metrics about teachers and their activity, 2) reports with general statistics about the use of the virtual campus, 3) dashboards with information about how students use the platform, their teaching material, and how they interact with this material 4) pedagogical tools (such as competence-based analysis services, social network analysis or learning design), and 5) service providing raw data from different sources.

Regarding students' perspectives, some of the above-mentioned tools and services fit well with their needs, such as tools to evaluate teachers and their activity, and dashboards about the use of the virtual environment and teaching materials. This aligns with teachers' perspectives, though teachers were reluctant to use metrics of their activity for evaluation. Instead, they preferred to use these metrics to improve teaching methodologies. However, our analysis also revealed that some of the needs of students and teachers were not well addressed with existing tools and services, such as feedback, personalization and adaptation. For example, we present two quotes: the first one is from a student and the second one from a teacher.

S3: "I think feedback that I have received from teachers have not been useful and this feedback should be improved a lot."

T3: "All in all, to adapt for each student cohort, which are different. ...It can be a very interesting tool for enabling interaction between students and teachers so that there can be empathy, connection, interaction, feedback."

Ethics and Privacy

All the 11 institutions had some ethical and privacy framework, usually driven by an internal committee at the institution. This ethical and privacy framework was not specific for LA, but it was generic for all the different aspects of the institutions. These ethical and privacy framework guarantee that the institutions comply with the Spanish regulations (e.g., Spanish Data Protection Law) and the proper international regulations (e.g., GDPR). The rules that are included in these frameworks include consent from students using a form, information to students about the purpose of the collection of data, anonymization of data when required, securing the data, etc. In some occasions, stakeholders stated that data are anonymous, and they are always inside the institution..

About the priorities of the institutions regarding ethics and privacy, Table I presents the results of the priorities that at least one of the managers considered important.

Regarding the main students' expectations and concerns, they are the following: 1) students would like to be aware of the specific data that the university is collecting, how it is processed and analyzed, and the purposes of data collection and analysis; 2) students do not remember the specific conditions under which the data is collected. They signed the legal conditions when they enrolled the university, but they

would like that the legal conditions could be accessible online at any time, e.g., through a website; 3) they would like their data to be used for improving learning but not for other purposes such as selling data to third parties; 4) students feel they are the owners of their data; and 5) data should be anonymized.

Regarding teachers' perspectives, the main expectations and concerns are the following: 1) teachers would like students' data to be used for improving learning but not for other purposes, as similar to the students' points of view; 2) Anonymity is also important; and 3) Students and teachers should be aware of the data collected.

[Table I about here]

Other Policy Aspects

There are few LA policies in HEIs in the world and in the case of Spain there are not any complete LA policies in the analyzed institutions. Apart from the ethical and privacy aspects presented in the last section, Table II shows the aspects that at least one of the managers considered important.

[Table II about here]

Challenges

The main challenges identified that hinder the adoption of LA are organized into different categories: 1) lack of knowledge and engagement of LA, 2) lack of LA strategies, 3) cultural issues, 4) technological issues, and 5) other relevant issues related to training, resources and knowledge of state the art.

Lack of knowledge and engagement of LA

Among all the presented challenges by the different stakeholders of the institutions, the one that was cited by most of the institutions (6 out of 11) was the lack of knowledge or engagement about technologies of LA, which includes the absence of interest for them or lack of knowledge about the utility and usefulness of LA tools and services. All of this makes a lack of engagement by leaders and of different stakeholders involved in the process and a lack of institutional support. Regarding this challenge (i.e. the lack of knowledge or engagement about LA), the advantages of LA should become clear (e.g., the services should enable to answer questions which enable to improve the learning processes) and communicated in the best possible way. More information is required for the key stakeholders in the institutions. Moreover, sometimes, teachers, students or managers can even see some benefits, but they could think that the risks and the effort are greater than the benefits. Among the risks, the process might be too time consuming. It should be demonstrated that the adoption of LA is worth for an institution and the time invested will be rewarding with the benefits.

Lack of LA strategies

The second key challenge identified (cited by four of the institutions) is the need to define a complete strategy of LA. It is an issue how to define a strategy with the different steps that is suitable for each institution and there are not many examples of strategies available to follow.

Cultural issues

Three institutions highlighted cultural issues and the difficulty to introduce change in the institutions. When something new is proposed, a transformation is required in the organization, which involves a change in the way of thinking and way of behavior of employees of the organization. These changes might not be automatic but might need progressive adoption. In addition, the structure of the institutions

might stop these changes (e.g., if the institution is very centralized or decentralized). In some occasions, there might be the case of different people in the organization with different paces and some of them adopted changes while others continued without introducing these changes.

Technological issues

Only two institutions mentioned technological issues when adopting LA, e.g., enabling interoperability among different systems and databases. This demonstrates that technical issues are important but are not the main concerns for key decision makers in Spain at this moment since LA technology has evolved a lot and it is moderately mature at this moment.

Other relevant issues related to training, resources and knowledge of state the art

Furthermore, important aspects raised by the institutions were: 1) the need of training teachers and students, so that they can know how to use, analyze and interpret LA tools and services; 2) the need of funding and resources (human and material) for the application of different LA tools and services; and 3) the difficulty to know all the previous state of the art and knowledge that can be connected to the adoption of LA in an institution and take advantage of this previous knowledge and best practices from the state of the art and from other institutions.

Discussion

In this section, we discuss the results of the previous section in the same order.

Level of Adoption

Few institutions had an institutional LA project, and the ones that were running either were very limited (e.g. just providing raw data available) or/and were not used by a large number of stakeholders. As for LA that were not implemented at the institutional level, but led by researchers, they were usually targeted at specific courses taught by the leading researchers or they were implemented as a pilot project. In addition, none of the institutions had a complete LA policy but all of them take care of the rules about ethics and privacy and just a few of them had initial strategies about LA.

Therefore, the level of adoption of LA in Spain is at an early stage and there is room for improvement at both points: implementing LA projects at large scale at institutions and defining and setting up LA policies.

Comparing Spain with the general situation in Europe, we can conclude that the situation is quite similar as there are 21 institutions out of 51 that had some LA institutional project (even if most of them are not institution-wide) according to the interviews conducted with the senior managers in HEI in the SHEILA project (Tsai et al., 2018a), which matches with the 4 out of 11 of Spain (Tsai et al., 2018a). The results are also according to recent studies that claim that there is little experience of transferability to practice in LA (Viberg et al., 2018) and that there is a need of large scale adoption (Dawson et al., 2019).

Objectives and Goals

The improvement of teaching and learning processes was the main common objective of the assessed institutions. Depending on the specific institution, their specific main objectives and goals were very

different ranging from teachers' analytics, predictive analytics or visual analytics. Therefore, institutions in Spain do not have all the same common specific objectives but it is heterogeneous, which is normal since the institutions have different number of students, cultures, some are public while others private some are online while others are traditional ones. This matches with the idea that "learning analytics must be considered in a broader context of interconnected organizational, social, and political structures that form modern educational institutions." (Gasevic et al., 2019) [p. 350].

Students' and teachers' perspectives agreed with managers on the need of improving the teaching and learning process as the global objective. They also agreed on quite a few specific objectives of LA such as providing meaningful dashboards, improving courses and materials and providing feedback. Students and teachers added the need of adaptation and personalization as one of the key objectives, which was not mentioned by managers. The reason why managers did not include it might be that adaptation and personalization can be considered a more complex service that should be envisioned for further phases. Students and teachers did not mention other aspects pointed out by managers maybe because they are more high-level aspects which are closer to managers.

One aspect in which there was agreement between managers and students was the need of analyzing teacher activity so that teachers can improve their own learning. Teachers also agreed that retrieving teacher activity is important but without using it for evaluation purposes as some indicators might not be accurate.

Learning Analytics Tools and Services

The considered tools by stakeholders are quite aligned with the objectives. The tools had distinct differences from each other, which reinforces the argument that LA can hardly be a one-size-fits-all solution (Gašević et al., 2016). The LA tools and services should be adapted to meet each institution's needs. The fact that data come from very different sources makes the generality of the tools difficult. In addition, given the fact that most of the reported projects were for research purposes, the tools were usually developed by researchers to test hypotheses and visualize the findings.

There was a good alignment among students' and teachers' needs and current tools but there are some desired tools for feedback or adaptation that were not covered by the tools in use reported by managers. Two examples of LA tools that are according to students' and teachers' needs but are not in use according to the managers' interviews are 1) tools for flipped classroom and 2) prediction.

Tools for Flipped Classroom

The interviews and focus groups show that managers, teachers, and students share some needs related to the improvement of courses and learning materials, the adaptation of the teaching process to the students' needs, and the feedback provided to students. These needs can be addressed with new active learning methodologies such as the combination of the flipped classroom (FC) with LA. This can be seen as a combination of analytics with learning design and frameworks for this linking have already been proposed (Bakharia et al., 2016).

Regarding the enhancement of materials, the tools should be able to detect possible problems in the resources. For example, techniques for analysis of video interactions (Li et al., 2015) can detect more

difficult videos, or it would be possible to detect exercises too difficult for the students comparing the number of attempts with the number of times that the exercise has been solved.

Regarding the enhancement of the courses and the adaptation, we can know whether or not the students have prepared the lesson (i.e., if they have watched the videos and done the exercises associated with this lesson), which exercises they are struggling with, etc. If teachers know this kind of information before the lesson, they can adapt it to the students' needs, such as planning activities to help students tackle the most difficult concepts (Rubio-Fernández, Muñoz-Merino, & Delgado Kloos, 2018).

Regarding feedback, LA can provide teachers and students with useful feedback such as if students are following the steps associated with a computer laboratory practice. Previous experiences in tools such as LOCO-Analyst demonstrated that users can find feedback valuable in LA tools (Ali et al., 2012). Recent studies further unpack the sensemaking process teachers follow when they use LA tools to inform teaching practice (Wise et al., 2019).

Tools for Prediction

From the previous analysis, there were no tools among the 11 Spanish institutions related to prediction which were adopted at institutional level. While it is hard to find institutions in that phase (not only in Spain, but in all the world), there have been contributions by individual researchers focused on predicting several outcomes. Despite the low institutional adoption of predictive models, it is important to know what key stakeholders think about it so as to align the design and implementation of these tools with the needs of the users. This subsection presents the opinions of experts, students and teachers about prediction.

Among the managers, there were explicit mentions of prediction in eight of them. Particularly, institutions with centrally-supported LA projects were more likely to reflect about it. The main desire of managers was to detect students at-risk of dropout. That would serve for future warning systems that alerts teachers and students about the situation and provides some recommendations (e.g., how to study). Moreover, as students' low performance seems to be an important challenge, other prediction outcomes are related to student behavior and success indicators of the degree.

As far as students were concerned, they would like LA systems to predict whether they were going to fail or not and alert them, so that they could react in time. Nevertheless, they indicated several challenges related to it. They were unsure whether data collected from virtual learning environments could be useful for predictions. Moreover, some respondents were reluctant to provide the results of predictions to instructors because this might create some stereotypes based on the data. The last point was debatable, as there were also students who recognized the importance of giving data to teachers, so that they could support their students. However, students also pointed out that teachers might receive information but did not know how to intervene. Some students also criticized that teachers often treat students as if their knowledge was the same. As a result, students proposed to use LA to detect students' weaknesses, so that teachers could use such information to provide additional resources and support for students.

When teachers were interviewed, they also acknowledged the importance of prediction and particularly forecasting students at risk of dropout and failure. Their concerns were different to students, however. They thought that as the number of students in a group could be high (e.g., groups of 200 students), it

was not possible to provide personalized support to all of them. Therefore, some respondents thought that predictions should focus on detecting the most critical students only. Another concern was about the level of interventionism. An interviewee thought that while it was important to support students, overinforming students could be counter-productive. Finally, teachers also discussed about the necessity of personal tutors to help students, and some respondents thought that they could be the people in charge of alerting students and giving advice. Moreover, the relevance of using prediction models was also present here as they thought prediction should also be used to decide which students actually need a tutor to provide support.

Ethics and Privacy and Other Policy Issues

Regarding ethics and privacy, Spanish institutions have internal committees to tackle these issues and they are aware of the different norms and regulations. However, these committees are not specific for LA but can be used for it as a specific case. For example, these committees can help to ensure that LA processes can accomplish the data protection regulations established by the GDPR.

All stakeholders agreed the following as main concerns and needs: the provision of information for students about the data collected and the processes, the main purpose should be the improvement of teaching and learning but not all the possible purposes should be allowed, and the risk of transferring the data to third parties. This entails that stakeholders have some concerns about how to ensure the privacy of data and the data governance, and they generally believe that data should only be used for improving learning, so that data privacy is not compromised for other purposes. Students and teachers were also concerned about anonymization of data. Students also go further with the provision of information as they consider the terms of the use of data should be always available and not just when it

is signed. Finally, managers have additional concerns that are more related to the institution such as the need of researchers' signatures when they do some work.

These concerns from stakeholders are aligned with previous works. Most concerns can fit within the transparency and student control over data as presented in (Pardo & Siemens, 2014). However, students did not mention as so important other aspects presented in (Pardo & Siemens, 2014) such as right of access, accountability and assessment.

From managers' perspectives, we can figure out a list of important aspects to take into account for a LA policy. These aspects include different phases of LA while others are transversal.

Challenges

If we compare the analyzed challenge perspectives in the context of Spain in this work with the challenges identified as an analysis of eight learning analytics policies (Tsai & Gašević, 2017), we can see that some of them are also part of this analysis which are the shortage of leadership capabilities, insufficient training, know previous success learning analytics implementations and policies.

Other recent works also used focus groups to understand stakeholders' perspectives regarding challenges for adoption of learning analytics in a context out of Spain (Young & Mendizabel, 2009). (Young & Mendizabel, 2009) use focus groups which are only targeted at teachers and staff. They also found some important challenges that are common to ours such as the need of leadership and the need of an effective planning and strategy. as the interview was with open questions and some answers were more specific.

Finally, it is important to note that despite the fact that teachers and students are positive about the use of LA (even when they are told about it for the first time in the focus groups) and they have certain demands of use of it (as it has already been mentioned), the mentioned challenges can hinder the adoption process. In some cases, it is not just that the institution does not know about LA (as some stakeholders may aware about it and demand it), but a proper leadership and strategic planning, together with LA policies (Tsai et al., 2018b) can also be needed for an effective adoption of LA at institutional level.

Conclusions

The situation, needs and challenges of LA in Spain have been analyzed taking into account the perspective from different stakeholders. A qualitative analysis was carried out based on the data collected from interviews with senior managers and focus groups with students and teaching staff.

Despite the fact that there are analyses of similar aspects of LA adoption for HEIs it is important to make an analysis in detail for specific regions such as in this paper for Spain. This is important because there can be cultural differences among regions. and it is relevant to analyze specific regions to better understand these possible differences so as to better support institutions in the adoption processes. In addition, most of the previous works do not use different stakeholders' perspectives, while this paper triangulates data from three different types of stakeholders in Spain (managers, teachers and students). The results of this paper can be used by other institutions to reflect on their situation about LA and compare it with the situation in some institutions of Spain.

Next, there is a summary of the main findings from the analyses, organized in different subsections related to the objectives.

Level of Adoption

This work can conclude that the level of adoption of LA in Spain at the institutional level is low. Only 4 of the 11 considered institutions had some LA projects at the institutional level, although these projects had limited functionality. Nevertheless, all institutions experienced with LA at the research level.

Objectives and Goals

Despite the fact that some objectives were common, some differences were identified depending on the institution, which entails that each institution may have different requirements and priorities. Among the common objectives, stakeholders agreed with the following: 1) improvement of the teaching activities based on teachers' interactions, 2) improvement of courses and resources, 3) use of dashboards, 4) feedback, and 5) personalization. However, teachers had some concerns about the use of data about their interactions because they are worried about the possibility of using them for teachers' evaluation purposes, which may increment the pressure among teachers and the dissatisfaction and disparity of teaching indicators among universities, which is a problem already reported in Spain (Muñoz San Roque et al., 2012).

Learning Analytics Tools and Services

The LA tools and services that are working in the institutions are very heterogeneous, partly because of the different needs of institutions and possible uses in research. Managers, teachers and students agree

that LA tools should provide feedback, personalization, adaptation, improvement of materials or useful awareness with dashboards. According to these needs, two examples of useful LA tools might be related to prediction and to the use of LA for the flipped classroom.

Ethics and Privacy

All the analyzed Spanish institutions have an ethical committee to comply with different regulations, but this is a general committee which is not specific for LA. However, LA aspects can be tackled within these committees. Ethical and privacy issues are very different depending on the institutions as well as the stakeholders.

Other Policy Issues

Although there have not been any LA policies in Spain, managers reported on many different aspects to take into account for future policies. There were very heterogeneous opinions about the priorities for LA policies but the combination of all the ideas give a starting point to make decisions (see Table II).

Challenges

With regard to the identified challenges, the most prominent one is to effectively communicate the importance and benefits of LA to key stakeholders to engage them. In addition, other important challenges were identified such as the need of defining a strategy or enabling change in the institutions, the need of training and the need of funding and resources. Technological issues were not among the most identified important challenges, however. Comparing the challenges within Spanish institutions

with those identified in (Tsai & Gašević, 2017), there is a match with the shortage of engagement among stakeholders, and the need of training and knowing other approaches from the state of the art.

This analysis has served to understand the situation of LA in Spain at the institutional level and connecting the needs and requirements from different stakeholders involved in the educational process.

There is a good agreement among managers, teachers and students in terms of the general objectives, tools or ethical requirements. For example, they agree about the need of personalization, feedback or dashboards and the need of different ethical considerations as a good information for students.

However, different stakeholders have also different needs and perspectives, for example all of them agree on the need of teachers' monitoring to improve the learning process but teachers would not like to have it as part of the evaluation process since it might not be accurate.

Limitations and Future Work

One limitation of this study is that we only included managers from a total of 11 Spanish institutions and a set of students and teachers from one institution. Moreover, the students and teachers were from engineering, humanities and social sciences backgrounds and future studies should try to diversity the disciplines of the participants. Although this would be a small sample for quantitative research, we consider it appropriate for a qualitative one, as the latter focus on obtaining rich insights from in-depth conversation with individuals. In addition, the inclusion of a diversity of stakeholders allowed us to extract useful insights into the current state of LA and expectations for LA in HEIs in Spain.

Nevertheless, as future work, this study could be extended to include a greater number of institutions and participants.

Future work may consider further analyzing the main barriers and proposed ways to overcome them to facilitate institutional adoption of LA. Moreover, other aspects such as how the financial situation may affect the implementation of LA could also be considered. In addition, it would be interesting to further explore the institutional adoption in other regions to be able to analyze what aspects can be generalized and how the experiences in some regions can be transferrable to others so as to speed up the process of adoption.

Disclosure statement

No potential conflict of interest was reported by the authors

Data availability

Questions of the Interview – available at:

https://www.it.uc3m.es/pedmume/files/Institutional%20interview_questions2.pdf

Student focus groups questions – available at:

https://www.it.uc3m.es/pedmume/files/Student%20FG_questions2.pdf

Teacher focus group question – available at:

https://www.it.uc3m.es/pedmume/files/Staff%20FG_questions2.pdf

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Tables

Table I. Results of the considerations about ethics and privacy by managers

Considerations about ethics and privacy

Sign an agreement of the researchers or people involved in the use of the data. Researchers, managers or other stakeholders involved in the use of the data for LA purposes should sign a confidentiality agreement and/or about they should treat with the data.

Only purpose should be to make research and improve the learning process. Other purposes are not allowed by default, such as giving the data to third entities.

Transfer of data to third institutions or companies. Students should be informed under which conditions their data can be transferred to other institutions or companies

The focus should be on the students.

Trade-off between privacy and possible functionality. Establish an agreement among the different stakeholders (students, teachers or managers) or even an agreement about all LA community that can guide the different institutions. All the data should be available for analysis but in an anonymous way. Sometimes the identity of a student should be revealed for personalization purposes. There should be an agreement about when the identity of students should be revealed

Communicate the risks that the participants take. Participants should be aware of the possible risks that they take when they provide their data.

Information about which type of processing of the data is going to be done. There are different types of processing that the institutions can make with the data. The institutions should inform about which are these types of processing to ensure processes are transparent

Table II. Results of the considerations about other policy aspects

Considerations about other policy aspects

Create a culture of data in the institution. Stakeholders should know the importance to use data to improve learning and their opinions should be taken into account as a central point, specially of students

Have proper leadership from managers. There should be multiple people in the institution being an

engine for the adoption of LA. In addition, there should be specific people in charge of making actions happen for the advance of LA.

Specify the objectives to achieve with LA. These objectives should be aligned with the general policy and strategies of the own institution. These objectives will imply what the institution will do with the data.

Data should be of good quality. There should be a process of cleaning data and the available data should be of good quality.

Specify the meaning of learning indicators as users might not interpret them correctly. Learning indicators are calculated about the learning process as part of the LA techniques based on user interactions. These indicators should be accurate, and teachers and students should know the exact meaning of these indicators and what they really represent so as to avoid misinterpretation.

There is a need for a plan. A plan of action is required for 5-10 years. This plan should be defined and evaluated by experts.

Combine pedagogical and technological aspects for the solutions.

Need of scale up the solutions. The solutions should be able to work for the whole institution and not just for a limited number of stakeholders.

Need of an interoperability policy. The institution should enable the combination of data from different sources, and a common format (such as xAPI: <https://xapi.com/>) and the integration of different sources should be defined for the institution to be able to use and combine data from different sources.

Set up a training plan for different stakeholders. For example, teachers and students should be trained to understand how to use the LA tools and services.
