The SHEILA Framework: Informing Institutional Strategies and Policy Processes of Learning Analytics

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ABSTRACT

This paper introduces a learning analytics policy and strategy framework developed by a cross-European research project team — SHEILA[1] (Supporting Higher Education to Integrate Learning Analytics), based on interviews with 78 senior managers from 51 European higher education institutions across 16 countries. The framework was developed adapting the RAPID Outcome Mapping Approach (ROMA), which is designed to develop effective strategies and evidence-based policy in complex environments. This paper presents four case studies to illustrate the development process of the SHEILA framework and how it can be used iteratively to inform strategic planning and policy processes in real world environments, particularly for large-scale implementation in higher education contexts. To this end, the selected cases were analyzed at two stages, each a year apart, to investigate the progression of adoption approaches that were followed to solve existing challenges, and identify new challenges that could be addressed by following the SHEILA framework.

Notes for Practice

- This paper presents a framework that can be used to assist with strategic planning and policy processes for learning analytics.

- This research builds on the RAPID Outcome Mapping Approach (ROMA) and adapts it by including elements of actions, challenges, and policy prompts.

- The proposed framework was developed based on the experiences of learning analytics adoption at 51 European higher education institutions.

- The proposed framework will enhance systematic adoption of learning analytics on a wide scale.

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1. Introduction and Background

Learning analytics (LA) has emerged as an interdisciplinary field that brings together research and practice in education, psychology, and data science. It collects, measures, analyzes, and reports data about learners for the purpose of leveraging human decisions to improve learning and the environments where it occurs (Long, Siemens, Conole, & Gašević, 2011). Siemens, Dawson, and Lynch (2013) argue that data captured while students are engaged in authentic learning can provide

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[1]   http://sheilaproject.eu

great insights into the social and pedagogical dimensions of learner performance. The analysis of such data can advance our understanding of the learning process and in turn informs a learning design and strategy. In the 2018 NMC Horizon Report Preview (EDUCAUSE, 2018), LA is mentioned as an important educational technology to support adaptive learning. It is believed that adaptive learning technologies can potentially provide a solution to the "iron triangle" of educational challenges, including the increasing cost of higher education, the challenge of providing access to new generations of students, and the need to maintain and improve educational quality. LA can be used to create flexible pathways to learning success, target at-risk student populations, and assess factors that affect completion and student success.

Despite the increasing interest among higher education institutions (HEIs) in employing learning analytics to increase the quality of teaching and learning, there are often barriers that prevent data from being used systematically and effectively. For example, data quality, ownership, access, organizational culture, and expertise available to implement learning analytics are prevalent issues that need to be addressed (Bichsel, 2012). Siemens et al. (2013) contend that learning analytics includes technical, cultural, and social aspects, and as such its associated challenges are not limited to technical problems only. Therefore, an institutionally wide strategy (a plan of action to achieve goals and objectives) will be needed to build analytics mindsets, capabilities, and capacity. However, research has found that although funding opportunities for LA research and activities have increased, there is still a lack of systematic and large-scale implementation of LA in higher education (Ferguson et al., 2014; Tsai & Gašević, 2017b). In order to establish analytics sustainability, it is imperative that HEIs align the adoption of LA with their institutional vison and goals (Siemens et al., 2013). Moreover, HEIs need a strategic planning process to overcome institutional resistance to innovation and change (Macfadyen, Dawson, Pardo, & Gašević, 2014). Further, Prinsloo and Slade (2013) point out that the harvesting, use, and dissemination of data requires an institutional policy (a set of guidelines and principles) that aligns with national and international legislative frameworks, to ensure an enabling environment for LA. It is important to establish principles to guide the stakeholders and encourage ethical use of data within an educational system where power is unequally distributed among different stakeholders.

In light of the need for a sound policy and a strategic planning process that is tailored to meet individual institutions' unique contexts and ensures a responsible and effective use of student data for LA, the SHEILA (Supporting Higher Education to Integrate Learning Analytics) project[2] was launched in 2016 with the goal of assisting HEIs to become mature users and custodians of digital data concerning their students. With evidence collected from direct engagement with stakeholders to understand their perceptions, expectations and concerns, a framework (addressed as the SHEILA framework[3] hereafter) has been developed to assist with policy and strategy formation processes for institutional adoption of LA. Existing models that seek to guide the adoption of LA in higher education include Jisc's "Code of Practice for Learning Analytics" (Jisc, 2015) and The Open University's "Policy on Ethical use of Student Data for Learning Analytics" (2014). However, these ethical and privacy guidelines may not always apply to every institution's unique context. The SHEILA framework collates the adoption experiences of LA from a wide array of HEIs in Europe and it serves as a resource for the preparation of an institutional policy or strategy for LA. The SHEILA framework was built using the RAPID Outcome Mapping Approach (ROMA; Macfadyen et al., 2014). Although the literature has suggested that the ROMA model is an effective tool to support systematic adoption of learning analytics in HEIs (Ferguson et al., 2014; Macfadyen et al., 2014), there has been limited work that purposely involved different stakeholder groups to validate the feasibility of this tool for LA strategy and policy development. The contribution of our work is to bridge this gap and adapt the use of the ROMA model to address challenges recognized in the literature and raised by different stakeholder groups.

While the final product of the SHEILA framework will reflect the perspectives of various stakeholders, including institutional leaders and decision makers, teaching staff, students, and LA experts, this paper focuses on the first SHEILA framework, which was developed based on 64 interviews with 78 senior managers from 51 European HEIs. Considering the scope of the paper, we selected four representative cases to illustrate the concept of the framework, as well as potential ways to use it for institutional strategic planning, readiness assessment, and policy formation for LA. To this end, the four cases were analyzed in two periods of time a year apart from each other, to demonstrate the progression of adoption, the way existing challenges were handled, and the way new challenges could be addressed according to the SHEILA framework.

2. Literature Review

In spite of the potential to provide better information about student learning behaviour and progress, thereby improving the quality of educational offerings and optimizing learning, LA has met a number of challenges that need to be tackled through a strategic planning process. In this section, we outline issues identified in the literature under three themes: 1) the demand on resources, 2) issues of ethics and privacy, and 3) stakeholder engagement and buy-in, and introduce the ROMA (RAPID

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[2] http://sheilaproject.eu/

[3] http://sheilaproject.eu/sheila-framework/

Outcome Mapping Approach) model, on which the SHEILA framework is based.

2.1. Learning Analytics Challenges

2.1.1. Demand on Resources

The first main issue covers challenges associated with data and technological infrastructure, financial resources, and human resources. The implementation of LA typically involves complex computing and aggregating of large amounts of data, in addition to management challenges, such as the integration of research tools into existing learning environments (Higher Education Commission, 2016). These tasks can be difficult to perform with traditional data management technologies (Jeremic, Kumar, & Graf, 2017). A survey carried out by EDUCAUSE to investigate analytics landscapes in US higher education revealed that data-quality concerns and system-integration difficulties were part of the major challenges to embedding the use of LA into institutions (Arroway, Morgan, O'Keefe, & Yanosky, 2016). These findings suggest a need for financial investment in advancing institutional data infrastructure to enable LA. However, the same study by EDUCAUSE also found that LA remains an interest rather than a major priority at most institutions (Arroway et al., 2016). This finding highlights the challenge of obtaining sufficient financial support to develop a technological environment for LA or appointing analytics specialists in many HEIs if LA has to compete with other institutional priorities. For example, another EDUCAUSE report based on the same survey data pointed out that institutional analytics was twice as likely to be described as a major priority as was learning analytics, and 4 in 10 institutions reported little or no investment in learning analytics (Yanosky & Arroway, 2015).

Another key dimension is human resources, which includes both the availability of staff time and the expertise required to implement LA. In a complex educational system, the introduction of a subtle change can meet substantial resistance because of the perceived increase in workload for staff (Macfadyen et al., 2014). As LA makes use of data from various sources, institutions not only need data experts to obtain and analyze good quality data, but they also need the users (e.g., administrators, teaching staff, and students) to have basic data interpretation skills and the ability to reflect on data critically, in order that LA may have positive impact on informing decisions and changing behaviour (Arnold et al., 2014; Pardo & Siemens, 2014; Wolff, Moore, Zdrahal, Hlosta, & Kuzilek, 2016). This has been identified as a common gap between needs and solutions in institutional analytics capacity (Norris & Baer, 2013; Siemens et al., 2013).

2.1.2. Issues of Ethics and Privacy

The second main issue has been identified as a major obstacle to gain buy-in from stakeholders, especially when the collection and use of data seem to risk intruding privacy (Roberts, Howell, Seaman, & Gibson, 2016; Slade & Prinsloo, 2014). Like all Big Data applications, LA relies on constant and ubiquitous collection of data from students. The wide range and types of data collected could induce discomfort among data subjects due to a sense of surveillance, leading to resistance to LA (Pardo & Siemens, 2014). One of the consequences is that students choose to opt out of the data collection and analysis processes, thereby compromising the quality of data available for LA. Moreover, while anonymity policies are commonly enforced in HEIs when personal data is used, it can be difficult to deliver customized interventions without retaining a certain degree of individual linkages (Rubel & Jones, 2016). This poses tension between ethical use of data and the full potential of LA. Similarly, Greller and Drachsler (2012) acknowledged the dilemma between keeping data anonymous and exploiting the most value of data. They also argued that fear induced by ethics and privacy issues can easily lead to misunderstandings and distrust in institutions, therefore hampering the adoption of LA (Drachsler & Greller, 2016). As a result, they proposed the DELICATE checklist for trusted learning analytics.

Another key issue associated with ethics and privacy is informed consent (Slade & Prinsloo, 2013). Rubel and Jones (2016) question the extent to which students can give informed consent. They point out that educational institutions may be transparent in their data practices, but the complexity of algorithms still makes analytics a "black box" for many. Moreover, the inherent information asymmetries between data collectors and data subjects mean students tend to have limited knowledge about who can access their data, what they do with the data, and what the consequences of invading privacy may be (Drachsler & Greller, 2016). Similarly, Prinsloo and Slade (2015) are concerned about the best time to seek consent from students. They suggest that consent seeking should focus on downstream users rather than on the time of the initial collection of data, because the benefits of opting-in or -out may not be apparent at the moment when an LA service is introduced. The conflicts between maximizing the efficiency and efficacy of LA and respecting data subjects' rights to control their own data can be challenging to institutions adopting LA on a large scale.

2.1.3. Stakeholder Engagement and Buy-in

The third main issue has been highlighted in a systematic literature review where Tsai and Gašević (2017a) pointed out that HEIs struggle to find common ground among different stakeholders regarding the adoption of LA, due to discrepancies in existing experience and knowledge of data, therefore resulting in different understanding of possible benefits and outcomes of LA. Moreover, according to Tsai and Gašević (2017a), only a handful of studies have tried to explore student perspectives

regarding the use of their data for learning analytics or the impact on their learning journeys, despite the fact that LA champions for a learning environment that is learner-centred and learner-concerned (Gašević, Dawson, & Siemens, 2015). The differences in perceptions of LA among stakeholders can lead to unequal buy-in if their needs are not met, further resulting in distrust in LA if concerns are not addressed. For example, Prinsloo and Slade (2017) specifically called for researchers to explore potential conflicts between students' concerns with their right to opt out and the implications of personal-level interventions from HEIs.

A direct impact of insufficient engagement with teaching professionals is the weak pedagogical grounding of LA technologies and implementation design (Jivet, Scheffel, Specht, & Drachsler, 2018). For example, Ali, Asadi, Gašević, Jovanović, and Hatala (2013) pointed out that LA tools still needed to move from spotting students at risk to providing pedagogically informed suggestions, and Macfadyen and Dawson (2012) suggested that institutions should balance solving technical challenges and developing pedagogical plans. Similarly, Ferguson and colleagues (2016) highlighted that much work on LA has concentrated on the supply side (the development of technological tools), and considerably less on the demand side (user needs), for example connecting LA with education in ways that can truly support the everyday learning, teaching, and assessment work. Failing to consider the pedagogical context in which data is generated and interpreted will affect teaching staff's perceptions of the usefulness of LA, thereby impeding broader buy-in and scalable actions of LA (Siemens et al., 2013).

The phenomenon of unequal engagement with stakeholders is also reflected by the absence of clear leadership to define directions for LA adoption among many HEIs (Higher Education Commission, 2016), which is considered a key factor associated with the maturity of LA practices at an institutional level (Colvin, Dawson, Wade, & Gašević, 2017; Norris & Baer, 2013; Siemens et al., 2013). In particular, the involvement of institutional leaders is crucial to the development of strategies and policies for LA, which could help mitigate the challenges identified so far. As new practices in a complex educational system potentially disrupt traditional management and organizational structures, and are therefore likely to meet resistance (Macfadyen et al., 2014), it has been suggested that institutions should start LA implementation by defining a strategic plan (Arnold et al., 2014; Colvin et al., 2015; Ferguson et al., 2014). Moreover, studies have identified that existing policies related to technical standards for interoperability do not fully apply to LA practices (Ferguson et al., 2016), and tailored LA policies for individual institutions will be needed in order to properly consider individual institutional contexts in every phase of adoption (Tsai & Gašević, 2017a). Without dedicated input from high-level decision makers (Colvin et al., 2015), it can be difficult to press for the development of LA-specific strategies and policies that meet the needs of individual institutions and the members therein.

In response to the need for a strategic framework and policy to adopt LA systematically, the SHEILA project has developed a framework using the RAPID Outcome Mapping Approach (ROMA). The ROMA model was adopted as a foundation due to its original purpose in supporting strategic planning and evidence-based policy development and change through active engagement with relevant stakeholders. The model has already been suggested for systemic adoption of LA in HEIs (Ferguson et al., 2014; Macfadyen et al., 2014) and employed in practice (Hainey, Green, Gould, Ramsay, & Milligan, 2018). The following subsection introduces the concept of the ROMA model.
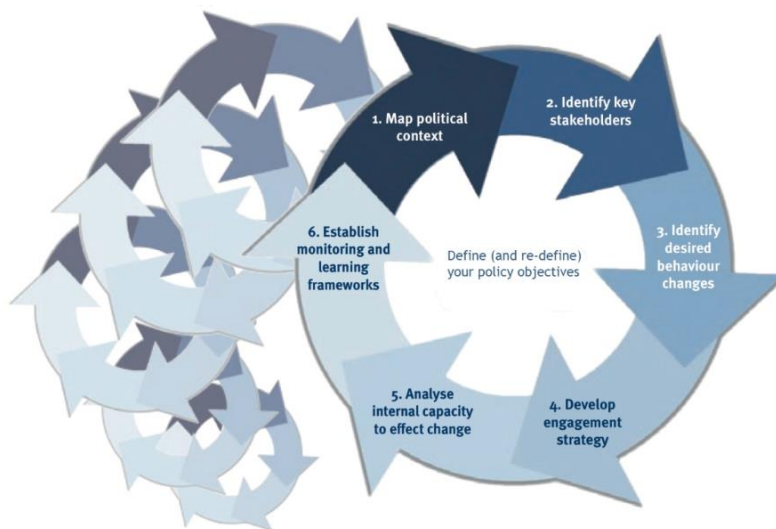

Figure 1. The RAPID outcome mapping approach (Macfadyen et al., 2014).

2.2. The ROMA Model in Learning Analytics Contexts
The ROMA model was designed by the ODI (Overseas Development Institute) to inform policy processes in the field of

international development using research evidence (Young & Mendizabal, 2009), and has been adapted to guide the planning and implementation of LA at an institutional level (Ferguson et al., 2014; Macfadyen et al., 2014). The adapted model (Figure 1) begins by defining an overarching policy objective, which is followed by six steps designed to provide policy makers with context-based information: 1) map political context, 2) identify key stakeholders, 3) identify desired behaviour changes, 4) develop engagement strategy, 5) analyze internal capacity to effect change, and 6) establish monitoring and learning frameworks. Unlike traditional linear tools and approaches, ROMA is designed to be used iteratively (as the spiral arrows indicate) to inform strategic choices and meet unexpected changes (or challenges) in a complex setting.

Ferguson and colleagues (2014; 2016) provided two case studies of LA practice from the UK and Australia to demonstrate how theoretical frameworks could be operated in the real world and, in particular, how ROMA could be used for the planning and implementation of LA in higher education contexts to maximize the success and impact of LA. Our work builds on the approach adopted by Ferguson and others (2014) to map out the state of LA adoption among HEIs in Europe using ROMA. We identified key actions and challenges in the adoption, and further provided suggestions to guide policy development. The following section expands upon methods adopted to develop the SHEILA framework, followed by four case studies that have contributed to this framework.

3. Methodology

The final version of the SHEILA framework is planned to be based on evidence from a wide range of data, including an institutional survey administered to universities in Europe to understand the state of adoption of LA (n=46), a Group Concept Mapping activity that sought opinions from LA experts on essential features of an LA policy (n=30), 64 institutional interviews with mostly senior managers (e.g., provosts, rectors, deans, principals, vice principals, and vice/pro-vice chancellors) from 51 higher education institutions across 16 countries in Europe, and local consultations with teaching staff and students at four European higher education institutions using both a survey method and a focus group method. The SHEILA framework was developed in phases based on the findings from the aforementioned data.

This paper focuses on the output of the first development phase. The first version of the SHEILA framework was developed based on the results of an analysis of 64 institutional interviews that took place between August 2016 and February 2017. Each of these interviews lasted for 30 to 60 minutes. The number of participants in each interview ranged from one to three, and some participants from the same institution attended the interviews separately. This resulted in a total number of 78 participants from 51 institutions. Ten interview questions were developed to investigate 1) institutional plans for LA, 2) motivations for LA, 3) adopted strategy, 4) strategy development processes, 5) readiness preparations, 6) success and evaluation, 7) success enablers, 8) challenges, 9) ethical and privacy considerations, and 10) the interviewee's views of essential elements in an LA policy. Before the interviews started, the researchers explained the meaning of learning analytics to all interviewees to ensure a shared understanding. Although strategy and policy formation are the two main purposes of the SHEILA framework, these two terms were not specifically explained unless asked, since the interviewees were already familiar with these terms in their senior manager roles.

We used the ROMA model as a coding scheme to analyze each institutional case by mapping their LA-related activities to each of the six dimensions and the desired objectives (Figure 1) so as to identify the strategic approaches (key actions) that HEIs have taken to adopt LA. The analysis was carried out by a group of researchers who worked independently on coding different interviews, and met multiple times to discuss the results and calibrate the coding instrument further. During this process, we found that HEIs faced a number of challenges that could be associated with different ROMA dimensions, and both the key actions and prominent challenges need to be considered in policy formation and strategic planning process. We also found a strong connection between the six ROMA dimensions. That is, the same challenge may be identified in multiple dimensions, and an action may be informed by consideration of multiple dimensions at the same time. While the ROMA model is meant to be applied iteratively (Macfadyen et al., 2014), there does not seem to be a definite order between the dimensions. Therefore, we decided to treat them as "dimensions" rather than "steps" as initially suggested by Young and Mendizabal (2009), so as to acknowledge the fluidity between the six dimensions.

We synthesized the mapping results of the 51 cases and created a comprehensive table of all actions and challenges identified in the interviews. This process resulted in a list of 42 action points and 59 challenges across the six ROMA dimensions. Based on this result and the interviewees' views of essential elements to include in LA policy (interview question 10), we generated 47 policy questions to address the key actions and challenges. Thus, the SHEILA framework consists of a comprehensive list of adoption actions, relevant challenges and policy prompts, framed in the six ROMA dimensions. Figure 2 explains the concept and structure of the SHEILA framework, in which action, challenge, and policy elements interact with each other.

We further carried out an open coding analysis on the lists of actions, challenges, and suggested policy questions, and identified common themes including capabilities, culture, ethics & privacy, evaluation, financial & human resources,

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infrastructure, internal & external support, management, methodology, purpose, and stakeholder engagement. These themes helped us to identify the main focus of action in each ROMA dimension and prevalent issues to address.

The following sections discuss the mapping results of four distinct cases that are different from each other by institutional size, location, goals, and approaches to LA. While the data presented below only makes up part of our framework, our intention is to use them to illustrate the development process of the SHEILA framework, and to demonstrate how the SHEILA framework could be used iteratively to guide the development of institutional policies and strategic planning for LA.
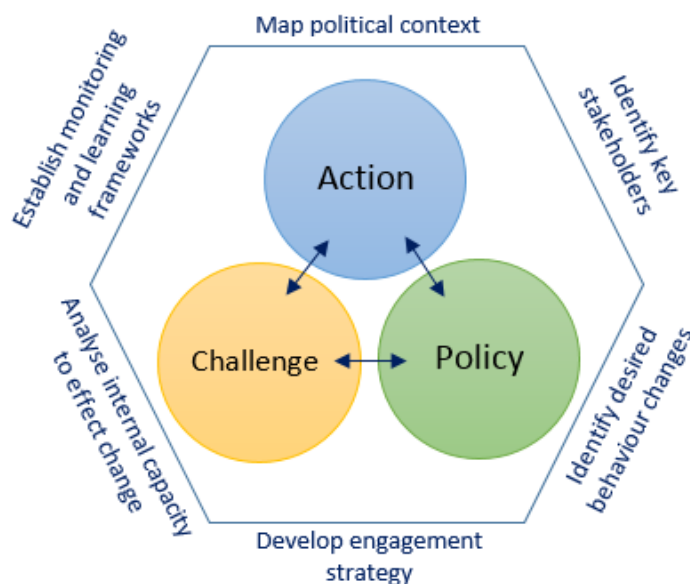

Figure 2: The SHEILA framework structure.

4. Results

In this section, we present the action points undertaken by the four selected institutions and the challenges that they faced, followed by a list of questions to reflect on when developing an LA policy in similar contexts. Each of the statements is associated with a theme. Section 4.1 presents the profiles of the four cases, including their approaches to LA. Section 4.2 presents the mapping results of the four cases using the ROMA model to demonstrate how we developed the SHEILA framework by scoping out the current state of adoption in European higher education.

4.1. Four cases

Institution A is based in the UK and has more than 30,000 students enrolled. At the time of the interview, institution A had one central university-sponsored LA project and a number of small projects initiated by individual teaching staff. In terms of the institutional uptake, institution A took an experimental approach to LA. That is, LA was adopted not as a tool to solve identified problems, but as a tool to explore new possibilities and innovations to enhance existing practice. Institution A's goal was to use LA to enhance curriculum design and student experience.

Institution B is based in Estonia and has more than 10,000 students enrolled. This institution had a few course-level LA projects previously, and was preparing an institutional LA project at the time of the interview. Institution B took a problem-based approach to LA, which is perceived as a potential solution to deal with student dropouts. The goal was to understand students' learning progress and provide interventions when needed.

Institution C is based in Spain and has more than 30,000 students enrolled. At the time of the interview, institution C did not have any institutional LA projects, although there were small-scale projects carried out by individual researchers. The main goal of these projects was to explore data collected from current and past courses to identify opportunities for teaching innovations.

Institution D is based in Switzerland and has fewer than 5,000 students enrolled. LA projects were launched as a result of the university's digitization strategy, with strong support from the management board. The main goal of the projects was to create an interactive learning environment and coordinate learning resources in a learning management system (LMS).

4.2. Six ROMA dimensions

An analysis of the four cases using the ROMA model shows that the most common themes of challenges identified in Dimension 2 (stakeholders) are ethics and privacy related issues, while those in Dimension 3 (desired changes), 4 (engagement strategy), and 6 (monitoring framework) are methodology related. Dimension 5 (capacity for change) examined the internal capacity of the institutions, resulting in a longer list of challenges being identified compared to the other dimensions. The common challenges in this dimension are related to culture and infrastructure. In contrast, the mapping of Dimension 1 (political context) did not identify shared themes among the comparatively shorter list of challenges. The following subsections are organized according to the six ROMA dimensions. Each section begins with a critical reflection on the state of adoption of LA among the four cases, followed by three tables providing further information on corresponding actions, challenges, and policy prompts respectively. These tables also present a selective part of the SHEILA framework, as illustrated in Figure 2.

4.2.1. Dimension 1: Map Political Context

The mapping of Dimension 1 revealed institutional drivers and needs for LA. Both Case A and B faced external pressure to perform quality evaluation, which usually forms part of the key performance indicators (KPI) in HEIs (Table 1). Therefore, it is particularly important for these institutions to reflect on the reasons for adopting LA — whether it is for the benefits of the institution or for learners and teachers (Table 3). While LA activities in Case C were still at a grassroots level, the same policy questions would be useful to reflect on when planning a strategic movement towards institution-level adoption. That is, align individual-level research activities with the wider university strategy, so as to gain support from senior managers/decision makers. The need to gain support from key leadership to enable systematic adoption of LA in Cases B and C has also been confirmed by the identified challenges (Table 2). By contrast, Case D has already adopted LA on the institutional level due to the strong support from key leadership and the university's digitization strategy.

Table 1. Map Political Contexts — Actions

Case	Action	Theme
A	The internal driver was to use data to inform teaching- and learning-related decisions, and an external driver was to provide data for audits (e.g., National Student Survey).	Purpose
	Given the size of the university, it was decided that a pilot study was needed to find the best way to extract and integrate data.	Methodology
B	The internal driver was to increase teaching quality and learning motivations. The external driver was to provide data for state-level quality evaluations, which had previously highlighted the problem of student dropouts.	Purpose
C	A key driver was to gain better understanding of course-related activities so as to improve the curriculum design.	Purpose
D	The main driver was to create rich LMS learning activities for students based on teachers' curriculum designs so that students could perform at the highest levels, while minimizing the costs of developing and maintaining complex learning resources in the LMS.	Purpose

Table 2: Map Political Contexts — Challenges

Case	Challenges	Theme
A	No challenges were identified.	N/A
B	There is no central guidance from the government regarding the use of student data in university feedback systems.	Management
C	Decentralized leadership made it difficult to take a centralized approach to LA.	Methodology
D	No challenges were identified.	N/A

Table 3: Map Political Contexts — Policy Prompts

Policy — questions to reflect on	Theme
Which problems are to be addressed by using LA?	Purpose
What are the reasons for introducing LA to students and staff?	
How do institutional objectives align with personal benefits for teaching staff and students?	

4.2.2. Dimension 2: Identify Key Stakeholders

The mapping of Dimension 2 showed that the adoption of LA in the four cases involved a wide range of stakeholders, both internally and externally (Table 4). A key implication for policy is to consider the responsibilities and rights of everyone involved, in addition to the impact on them (Table 6). Case B, in particular, faced an ethical dilemma about how to make opt-out choices available while addressing institutional challenges that involve every member of the institution (Table 5). While

there is no easy solution for this challenge, defining the circumstances of enforcing opt-out/-in choices, anonymity, and limited access to data in a policy can effectively minimize conflicts. In contrast, Case C was concerned about data re-identification, which would need to be addressed by evaluation action in Dimension 6 (see Section 4.2.6), whereas Case D raised transparency issues regarding external parties' access to student data. An implication of these challenges for policy is to define rules about sharing data with researchers and external parties to ensure that data collection and analysis align with institutional goals and protect the right of data subjects.

Table 4. Identify Key Stakeholders — Actions

Case	Action	Theme
A	The primary internal stakeholders included students, teaching staff, senior managers and a working group made up of representatives from various units. The external stakeholder was an LA service provider that offered warehousing and analytics expertise.	Stakeholder engagement
B	The primary internal stakeholders included students, teaching staff, IT officers, senior managers, and the department of academic studies. The need to involve external stakeholders — such as LA experts and data scientists — was identified.	Stakeholder engagement
C	The main stakeholders were researchers and IT officers. However, there was indirect engagement with external researchers through the engagement of LA literature and conferences.	Stakeholder engagement
D	The primary internal stakeholders were teachers, study program leaders, learning and teaching support and facilitation group, and senior managers. External stakeholders include external content providers (e.g., publishers) and governing bodies that ensure adherence to European and national data privacy laws.	Stakeholder engagement

Table 5. Identify Key Stakeholders — Challenges

Case	Challenges	Theme
A	It was difficult to define ownership and responsibilities among professional groups within the university.	Management
B	The provision of opt-out choices conflicts with the goal of tackling institutional challenges that involve all institutional members.	Ethics & Privacy
C	Anonymized data could potentially be re-identified when matched with other pieces of data.	Ethics & Privacy
D	It is not transparent if and how external partners (e.g., publishers) collect and process data about students.	Ethics & Privacy

Table 6. Identify Key Stakeholders — Policy Prompts

Policy — questions to reflect on	Theme
Who is the policy for?	Stakeholder engagement
How will responsibilities be defined for each stakeholder?	
Whose data will be collected?	Methodology
How will consent be obtained?	Data management
Is there a choice to opt out of (or opt into) any data collection and analysis?	
Who collects data?	
Who can access the data?	
How will anonymity policies be applied to the processing and presentation of data?	
Will data be shared with researchers?	
Will data be shared with external parties? Is this justifiable?	

4.2.3. Dimension 3: Identify Desired Behaviour Changes

The mapping of Dimension 3 showed that the expected changes for Case B were particularly "institution-focused," while those identified in Cases C and D were "teacher-focused" (Table 7). Although Case A expected to see behaviour changes among all three levels of stakeholders, there was a concern that expectations may not be met (Table 8). A similar concern about returns on investment was observed in Case B where LA was also driven centrally by the institution. Therefore, it is important that the policy not only guides decision makers to focus on changes that meaningfully reflect the goals set out for LA (Table 9), but also a range of indicators that can truly reflect these changes in a specific institution's context. The latter could be defined as success indicators, as suggested later in Dimension 6 (see Section 4.2.6).

Table 7. Identify Desired Behaviour Changes — Actions

Case	Action	Theme
A	Teachers will better understand students' learning problems and offer support accordingly. Students will be able to reflect on how they learn, and make learning plans accordingly. The institution will be able to make better decisions to support learning and teaching based on an overview of learning and teaching effectiveness.	Purpose
B	Student dropout rates will decrease. Students will be provided with regular reports about their learning progress. The institution will make better decisions to enhance teaching quality and keep students motivated.	Purpose
C	Teachers will better understand student learning behaviour, thereby improving the way they teach. The institution will improve the quality of their educational services.	Purpose
D	Teachers will embed more educational technologies into the design of courses/programs. Teachers will have a better understanding of students' learning processes. Teachers can identify the need for learning support in time.	Purpose

Table 8. Identify Desired Behaviour Changes — Challenges

Case	Challenges	Theme
A	An experimental approach is susceptible to a sense of uncertainty about the return on investment.	Methodology
B	It is unclear if a problem-based approach guarantees a solution.	Methodology
C	No challenges were identified.	N/A
D	No challenges were identified.	N/A

Table 9. Identify Desired Behaviour Changes — Policy Prompts

Policy — questions to reflect on	Theme
What changes will LA bring to the current situation? Why are these changes important to us?	Purpose
Who will benefit from learning analytics? How will the purpose of learning analytics be communicated to primary users?	Stakeholder engagement

4.2.4. Dimension 4: Develop Engagement Strategy

The mapping of Dimension 4 showed that engagement data was considered primary data for LA in all four cases (Table 10). The implication for policy is to define the range of data being collected and encourage "meaningful selection" of data, so that LA will not be driven by data, but by learning or teaching goals (Table 12). Case D has shown that an incremental approach to developing the data policy would meet practicalities of day-to-day use of learning analytics. It is also crucial to include students and teachers in the interpretation of data so as to contextualize data and increase the validity of analytics. For example, the key challenges that Cases A and C faced indicate the importance of including teaching professionalism in the design and implementation of LA (Table 11). A common strategy shared by all four cases was to set up a working group to drive LA. It is important that the policy states the responsibilities of the working group, particularly their role in ensuring that LA will be used responsibly within the institution. For example, the working group in Case B will need to make sure that relevant data protection regulations have been consulted, as it is not evident in the reported actions. In some countries, such as Cases A and D, ensuring that institutional data collection, processing, and use operate within legal frameworks requires support from government and not-for-profit organizations.

Table 10. Develop Engagement Strategy – Actions

Case	Action	Theme
A	The initial engagement with LA was guided by Jisc's (2015) Code of Practice for Learning Analytics. There were preparations to develop an institutional policy to provide a framework for the use of LA in the local context.	Ethics & Privacy
	Two LA specialists and a working group were set up to facilitate a pilot project with an LA service provider, engage with research activities, and develop institutional strategies.	Human resources
	The initial preparations included a review of existing LA cases. The sources of data used in the pilot project included interactions in virtual learning environments, Student Record Systems, and course marks. Sixty-five online MSc courses were involved.	Methodology

Table 10 (continued). Develop Engagement Strategy – Actions

Case	Action	Theme
B	A diverse working group was set up to drive LA activities.	Human resources
	The working group will initiate communications among different stakeholders.	Stakeholder engagement
	The initial preparations included a review of existing LA cases and visits to other European universities to learn from best practices.	Methodology
	The data sources included engagement data in LMS and data held in SIS (Student Information System).	
C	There were consultations on the Spanish LOPD (Organic Law on Protection of Personal Data).	Ethics & Privacy
	There was a plan to set up a working group to promote LA among teaching staff and develop ethical guidelines.	Human resources
	Social interaction data was extracted from discussion forums in the LMS.	Methodology
D	National privacy and data protection laws are being translated into organizational practices.	Ethics & Privacy
	A working group is driving the development of a data policy for learning analytics.	Human resources
	LA projects are part of the university's digitization strategy.	Internal & external support
	A data policy that is tailored to meet the needs of the institution is being developed incrementally based on teachers' day-to-day practices.	Methodology
	Training and support are provided to teaching staff to embed LA into their courses.	Stakeholder engagement

Table 11. Develop Engagement Strategy — Challenges

Case	Challenges	Theme
A	Overreliance on data and failure to consider the experience and knowledge of instructors/tutors about students.	Methodology
B	While there was funding support from the government to develop student feedback systems among Estonian universities, there was no state-level coordination to initiate collaboration among universities that have received the grant.	Management
C	Too much focus on identifying students at risk while overlooking the pedagogical design of curriculum or learning support	Methodology
D	Better identification and understanding of privacy and ethical implications when working with data on different levels (e.g., within a course, across multiple courses, and across the whole academic program).	Ethics & Privacy

Table 12. Develop Engagement Strategy — Policy Prompts

Policy — questions to reflect on	Theme
What are the objectives for LA?	Purpose
What kinds of data will be collected to achieve these objectives?	Methodology
What is the scope of data collection?	
How will the results of analytics be interpreted within the context? Will teaching staff or students be involved in the process?	
Who will oversee ethical conduct related to learning analytics?	

4.2.5. Dimension 5: Analyze Internal Capacity to Effect Change

The mapping of Dimension 5 showed that the evaluation of internal capacity focused on financial, infrastructure, and human capacity (Table 13). A common challenge shared by the four cases was in gaining wide support from the teaching staff among whom analytical literacy, time availability, and resistance to change were the main issues (Table 14). The implication for policy is to ensure the availability of communication channels and support resources among different stakeholders (Table 15). While all cases identified the challenge of accessing certain "useful" data, Cases A, B, and D recognized that ethical conduct needs an enabling infrastructure. Thus, it is crucial that the policy provides guidelines to keep the infrastructure updated regarding current data protection requirements.

Table 13. Analyze Internal Capacity to Effect Change — Actions

Case	Action	Theme
A	A risk evaluation was performed to analyze internal capacity.	Methodology
B	There was government funding for the development of feedback systems to support students.	Financial resources
C	There was an evaluation of the availability and usefulness of data from the LMS.	Infrastructure
	Interest was expressed in cross-institutional collaboration on LA research projects to enhance the integration of LA.	
D	The institution evaluates technical and infrastructural demands regularly based on system usage and feedback from students and teachers.	Infrastructure

Table 14. Analyze Internal Capacity to Effect Change — Challenges

Case	Challenges	Theme
A	2018 GDPR (European General Data Protection Regulation) will bring changes to the way the university deals with student data.	Methodology
	The existing data infrastructure could not deal with individual opt-outs.	Infrastructure
	There was no single permission to use student data across the institution.	
	Some useful data remains inaccessible, e.g., the usage record of the digital library was kept by publishers.	
	If the institution failed to properly manage one student's request to be excluded, the unhappiness of that student might spread to others and start an institution-wide objection. The buy-in from teaching staff was polarized.	Culture
B	The culture of using data to inform decision-making was immature.	Culture
	Although compulsory training was planned for teaching and support staff, it was not clear how to foster ownership of LA among staff. The benefit of using LA to support decision-making was clear to senior managers but not to teaching staff.	
	The existing infrastructure is not mature enough to process data from the LMS or to cope with privacy requirements, such as allowing individual opt-outs.	Infrastructure
	Potentially useful data for achieving the goals of LA may not be accessible due to privacy issues.	
	There was a skill gap in analytics and LA project design, which posed questions regarding the validity of the current approach to LA.	Capabilities
C	The skills required to understand and interpret visualized data needed to be installed among teaching staff.	Capabilities
	Worries about the time demands in incorporating LA into teaching outweighed the perceived benefits of LA, and reduced the motivation to attend relevant training.	Culture
	Certain data outside the LMS is hard to acquire, such as social interactions in a physical classroom.	Infrastructure
D	Insufficient understanding of technology leads to resistance among teaching staff.	Culture
	Existing LMS functionality does not meet teacher needs and the updates of the system is cost-intensive. Some data is not accessible.	Infrastructure
	Existing data policies do not speak to teachers because policy makers have insufficient understanding of how collected data relates to existing teaching practices.	Capabilities

Table 15. Analyze Internal Capacity to Effect Change — Policy Prompts

Policy — questions to reflect on	Theme
How will data integrity be achieved?	Methodology
How will the data be stored and disposed of?	Data management
How often will the efficiency and security of existing data infrastructure be evaluated?	
Are there related policies at the institutional/national/international level that the LA policy sits alongside/above/below?	Policy management
What communication channels or feedback mechanisms will be in place?	Stakeholder
What training will be deployed? Will it be compulsory?	engagement

4.2.6. Dimension 6: Establish Monitoring and Learning Frameworks

The mapping of Dimension 6 showed that none of the four institutions had developed success criteria or defined monitoring procedures due to the early stages of adoption. Nevertheless, Case D recognized the difficulty to isolate and measure the impacts of LA on student performance given that LA is one of the many tools adopted in an academic program. However, the challenges that confronted them indicate the urgency and importance of defining success measures for LA in their contexts, particularly with the grounding of learning and teaching theories (Table 16). More importantly, the policy needs to raise awareness about inadvertent consequences that may result from analytics, and suggest procedures to monitor and deal with these risks (Table 17).

Table 16. Establish Monitoring and Learning Frameworks — Challenges

Case	Challenges	Theme
A	There was fear of failing to meet expectations, resulting in a bad name for LA.	Methodology
B	It remains questionable whether student dropout rate is the best success indicator for the institutional LA project.	Methodology
C	The captured data of time spent online may not truly reflect learning. The design and implementation of LA may fail to consider pedagogical theories.	Methodology
D	The impacts of LA tools on student performance is hard to isolate and measure	Methodology

Table 17. Establish Monitoring and Learning Frameworks — Policy Prompts

Policy — questions to reflect on	Theme
How will success be measured? What are success indicators?	Evaluation
What are the mechanisms that deal with inadvertent consequences?	
Who will carry out the evaluation of impact?	
How often will the policy be reviewed and updated?	Policy
Who will be responsible for the policy?	management

5. Discussion

The associated themes that emerged in mapping the results show a different focus for each ROMA dimension. Dimension 1 (mapping political context) focuses on identifying the "purpose" for adopting LA in a specific context so as to drive actions in the other dimensions. Dimension 2 (identify key stakeholders) is driven by the recognition that the implementation of LA in a social environment involves collective efforts from different stakeholders. Dimension 3 (identify desired behaviour changes) sets objectives, which reflect back to the "purpose" of adopting LA. Dimension 4 (develop engagement strategy) defines approaches to achieving the objectives by addressing aspects that could otherwise become challenges, as identified in the literature: 1) resources, ethics, and privacy, and 2) stakeholder engagement and buy-in (see Section 2.1). Dimension 5 (analyze internal capacity to effect change) focuses on assessing the availability of existing resources (e.g., data and funding) and identifying challenges (risks). Dimension 6 (establish monitoring and learning frameworks) is currently absent in all four cases.

In terms of challenges that confronted the four cases, the mapping of Dimension 5 identified key themes around culture, capability, and infrastructure. This result coincides with two of the three key LA challenges identified in the literature — 1) demand on resources and 2) stakeholder engagement and buy-in, as introduced in Section 2.1. As a result, the policy questions focus on management issues around data integrity and security, and channels for stakeholder training and communication within the institution. The other key challenge — ethics and privacy — was particularly highlighted in the mapping of Dimension 2. This reaffirms the importance and urgency of addressing ethics and privacy issues that could otherwise impede buy-in from stakeholders. To this end, the policy questions particularly focus on management issues around privacy, such as consent-seeking, data access, anonymity principles, and data sharing.

While a policy does not necessarily provide direct solutions to the identified challenges, the questions in the SHEILA framework intend to prompt answers that could serve as a suitable code of practice to mitigate the challenges. For example, answers to the policy question — "how will anonymity policies be applied to the processing and presentation of data" (see Table 6) may not provide solutions to the data re-identification challenge that Case C faced (see Table 5), as it may not be foreseen before different data sets are integrated. However, a policy could suggest that a review and test process for such risks be carried out by data specialists before data is made available to a wider population of stakeholders. This may further inform actions of Dimension 4 and 5, as the availability of data could be determined by the associated risks of privacy and consequently affect engagement strategy.

As identified in the literature, stakeholder engagement and buy-in has a direct impact on the scalability and sustainability of LA (see Section 2.1.3), which need to be supported by strategic planning, led by institutional leaders, and informed by

pedagogical knowledge possessed by teaching professionals. This issue is reflected in the mapping results of challenges associated with Dimensions 1, 3, and 4, where "methodology" and "management" are key issues. As a result, the policy questions focus on defining the purpose of implementing LA and considering the value of LA to all relevant stakeholders and the specific context of the institution. Based on the identified purpose, the methodology adopted to achieve the chosen goal should also be stated in a policy, as suggested in Dimension 4.

This mapping process used for the four selected cases illustrates how we analyzed institutional adoption of LA using the ROMA model, and how we adapted the model into the SHEILA framework by highlighting action points, key challenges to address, and key questions to answer when developing an institutional policy or strategy. It is clear that the SHEILA framework can be used to initiate strategic and policy planning for early adopters. The following section shows how the SHEILA framework can be used to examine existing LA practices and refine strategies or update policies.

6. Case Updates and the Application of the SHEILA Framework

So far, we have used four selected cases to demonstrate how the first SHEILA framework was developed based on interviews with institutional leaders. In this section, we update the new progress of these cases a year after the initial interviews and use the SHEILA framework as an evaluation structure to assess the progress and identify gaps to bridge. In this way, we demonstrate how the SHEILA framework can be used iteratively to help institutions reposition their strategies and evaluate the need for updating existing policies.

6.1. Case A

A year ago, Case A was putting together a working group to drive LA initiatives, including the development of a policy (see Table 10). Thus far, Case A has developed a set of principles and policies, both of which have been through a consultation process with various stakeholders, as identified in Table 4. However, feedback on the institutional pilot project showed that LA did not meet expectations regarding its impact on teaching and learning in contexts where classes are relatively small. As a result, Case A is currently planning a new pilot project seeking to use LA to support distance learning at scale. With this new project, Case A also aims to address the previously identified challenge of insufficient consideration for teaching professionalism (see Table 11) by introducing an LA tool that gives teaching staff the freedom to choose the most relevant data sources and learning indicators to generate feedback. In addition, Case A has recognized that its institutional structure is too complicated and diverse to introduce a unified LA solution. As a result, the current strategy is not to enforce a blanket adoption of LA, but to target areas of need to introduce context-specific LA solutions.

Reflecting on the SHEILA framework, Case A's experience with the previous pilot project has helped them reshape their approach to LA. Although there was no specific evaluation framework developed at the time of the interview (Dimension 6), Case A has sought feedback from teaching staff regarding the impact of the project on identified desired behaviour changes (see Table 7). In addition, they have reassessed the institution's capacity (Dimension 5) to introduce an institution-wide project and the applicability thereof in the institutional context (Dimension 1). They have also tried to address the risk of disrespecting teaching professionalism (Dimension 2) by introducing a new LA solution that will enhance teacher agency (Dimension 4). The change in strategy indicates possible changes in key stakeholders (Dimension 2) and the need for staff training to build up capacity and understanding (Dimension 5). For example, the training could focus on guiding teaching staff to embed the new LA solution into their daily practices, while using their professional expertise and pedagogical understanding. Moreover, Case A could make use of the feedback on the previous pilot project to identify indicators of success and quality assurance for the new pilot (Dimension 6).

6.2. Case B

A year ago, Case B was preparing an institutional LA project to tackle student dropouts (see Section 4.1). The plan was to use personal data to develop algorithms for the evaluation of drop-out risks. However, this plan did not pass an ethics application after eight months of consultations with the university legal team. Currently, the working group is redesigning their approach to LA in order to comply with national legislation on data protection, which is influenced by GDPR.

Reflecting on the SHEILA framework, one possible approach to addressing the new challenge that arose in Case B's political context is by involving external stakeholders (Dimension 2), such as other universities in Estonia that are interested in adopting LA and policy bodies that make decisions about university funding and performance indicators. Collectively, these universities can prepare a joint statement for the Ministry of Education and Science to strike a balance between protecting students and encouraging educational innovation (Dimension 4). In this way, Case B could potentially resolve the conflict with the data protection regulations of the State, but also enhance internal capacity (Dimension 5) by sharing expertise from other institutions to develop LA services and solve technical issues around data usage.

6.3. Case C

Previously, Case C only had grassroots activities initiated by internal researchers in place. Decentralized leadership was identified as a barrier towards the institutional uptake of LA (see Table 2). Currently, the management team has recognized the importance of establishing teams to lead LA initiatives and communicate with teaching staff. In addition, there has been support from the IT department in the development of LA pilot projects. There is also increasing collaboration with external researchers. However, two new challenges have arisen during this process: 1) to gain buy-in from key instructors and 2) to identify relevant learning indicators for the development of learning dashboards.

Reflecting on the SHEILA framework, Case C's previous approach has not connected Dimensions 2 and 3. While one of the desired behaviour changes was to improve teaching quality (see Table 7), the identified stakeholders did not include teaching staff (see Table 4). The impact of this gap falls on the engagement strategy (Dimension 4) with key stakeholders, which also affects the institutional capacity (Dimension 5). Not surprisingly, the two new challenges that have arisen since the institution moved towards wider adoption are both related to the input of teaching staff. As a result, Case C will need to work out strategies to communicate the purpose of LA to this group of stakeholders and obtain insights into learning indicators based on the curriculum design and professional knowledge of teaching staff (Dimension 4).

6.4. Case D

A year ago, Case D had already been using LA at an institution-wide level to gain better understanding of student learning processes and to coordinate learning resources in the LMS, as part of the digitization strategy (see Section 4.1). Since then, the uptake of LA among teaching staff has increased significantly. About 15% of staff now use analytics-based indicators regularly to evaluate their course designs and support the assessment of students. Nevertheless, it remains a challenge to gain buy-in from staff who do not have sufficient understanding of the tool and refuse to change their teaching methods (Table 14).

Reflecting on the SHEILA framework, the training that Case D provided to teaching staff through workshops and presentations (Table 10) proved to be effective in increasing acceptance, as this provided teaching staff with concrete examples of how to use LA to benefit their teaching. Nevertheless, the identified challenge of resistance among other teachers needs to be addressed with a new strategy (Dimension 4). For example, Case D could consider inviting early adopters to champion LA to their colleagues by showing their success stories. They could also try to involve students in their planning and development processes, so as to bring student voices and needs to the teaching staff.

7. Conclusion

The first version of the SHEILA framework was developed based on the adoption experience of LA among 51 higher education institutions. We illustrated the development process of the framework using four representative cases to demonstrate the connections among actions, challenges, and policy considerations. Using the ROMA model, we analyzed actions carried out by these institutions and adapted the ROMA model further by including challenges associated with the six dimensions. Thereafter, we developed a set of questions to address the identified actions and challenges when formulating an LA policy and strategy. This mapping process demonstrated the evidence-based approach we adopted to develop the SHEILA framework. Furthermore, we updated the progress that the four cases have made over the year and used the SHEILA framework to assess the mutual impacts of actions and challenges among the six dimensions. We also identified gaps between dimensions that need to be addressed in order to improve the institutional adoption of LA in these four cases. In this way, we demonstrated that the SHEILA framework can be used not only to inform policies, but also to evaluate institutional readiness for LA, to inform strategies, and to assess the quality of existing practices.

This paper has presented a selective part of the first SHEILA framework based on a series of interviews with predominantly senior managers in HEIs. Therefore, it particularly reflects the perspectives of this group of stakeholders. Our future work aims to incorporate findings from other ongoing research activities, which explore views from other key stakeholders — such as teachers and students — regarding the adoption of LA.

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