

Coordinating learning analytics policymaking and implementation at scale

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Abstract

Many Latin-American institutions recognise the potential of learning analytics (LA). However, the number of actual LA implementations at scale remains limited, notwithstanding considerable effort made to formulate guidelines and frameworks to support the LA policy development. Guidance on how to coordinate the interaction between the LA policymaking and implementation is mostly missing, leaving a difficult challenge up to practitioners. In this study we propose a coordination model to support

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future LA initiatives at scale. We explore the problem by comparing two cases in Belgium and Ecuador. Following up we use the LA implementation timeline as a driver for planning the interaction between the policymaking and implementation. We continue by testing an application of the model with LA experts predominantly from Latin-American institutions, asking them to map low-level items of the SHEILA policy framework to four implementation phases. The results of this mapping support that LA policy building can be spread over time, that it can coincide with LA implementation at scale, and that both efforts can be coordinated. It is hoped that this study will provide additional guidance for future Latin-American and other LA initiatives.

Introduction

Learning analytics (LA) is about “collecting traces that learners leave behind and using those traces to improve learning” (Duval, 2012). As indicated by Ferguson *et al.* (2014), a key goal for LA is to move from small-scale research towards broader institutional implementation, but this introduces “a new set of challenges as institutions are stable systems and resistant to change.” Dawson, Joksimovic, Poquet, and Siemens (2019) observe that “over the past decade there have been a number of LA institutional adoption models proposed.” Despite these developments, there are currently few reports in the LA literature of deployment at scale (Dawson *et al.*, 2019; Ferguson *et al.*, 2014).

We argue that the coordination between implementation of LA and policymaking is underdeveloped. To address this gap, this paper aims at supporting a strategic institution-wide implementation of LA *at scale* by presenting a *coordination model* for policymaking and actual implementation of LA tools. The model we propose recognises that both efforts are mutually reinforcing, and can happen concurrently.

Practitioner Notes

What is already known about this topic

- Learning analytics (LA) solutions in higher education have yet to overcome difficulties in reaching scalability.
- Infrastructure and policy are important success factors, and studies have presented guidelines and frameworks to support institutional policy development for LA.

What this paper adds

- Shows that policy development and implementation of LA solutions at scale can happen concurrently.
- Proposes a coordination model using the implementation timeline to plan and facilitate the interaction between policymaking and implementation.

Implications for practice and/or policy

- Without contradicting the cyclical nature of policy development proposed by existing frameworks, practitioners may find a mapping to a more linear timeline easier to start when introducing LA at scale in their institutions.
- Especially for resource-constraint Latin-American institutions, the coordination model may help to create the necessary buy-in by coupling the policy development to the momentum of an ongoing implementation process.

A recent review by Viberg *et al.* (2018) on the current landscape of LA in higher education (HE) indicates that 94% of papers propose solutions that do not scale. To scale-up and sustain LA adoption, there has been a rising number of studies aiming at guiding the design and implementation of LA solutions at an institutional level. Since scaling up a LA solution requires involving different stakeholders and coordinating existing processes, most of this work has focused on the proposal of guidelines and frameworks to support LA institutional policy development. According to Dawson *et al.* (2018), these frameworks have been evolving over time and can be classified into three different groups: (1) input models, which define a set of dimensions or properties that are previously required for LA adoption; (2) output models, which represent outcomes expected from the process of LA adoption according to different levels of organisational readiness and maturity (Colvin *et al.*, 2017; Dawson *et al.*, 2018) and (3) process models, which map alternative approaches for LA adoption concerning the evolving needs and concerns raised by HE stakeholders.

Input models were the initial trend. An example is the Maturity Index proposed by the EDUCAUSE Centre for Analysis and Research, which conceptualises the maturity required for LA adoption in terms of infrastructure, IT involvement, investment and culture (Bichsel, 2012). Greller and Drachsler (2012) presented a generic framework which referred to data, objectives, instruments, stakeholders, and internal and external constraints as key dimensions. Although these models have been used by several researchers and practitioners, how they are to be operationalised remains unclear. Moreover, to the best of our knowledge, no case studies have been published on how these models have been translated into institutional actions or processes.

As an evolution of input models, *output models* were proposed as an approach to consider not only those aspects required for LA adoption, but also the expected outcomes from it. One example is the LA sophistication model proposed by Siemens, Dawson, and Lynch (2013). This model provides an overview of the stages of LA sophistication, including growing maturity and systems level deployment. Although output models are more explicit than input models about the outcomes that institutions might expect from LA adoption, these are still high-level (abstract) proposals in the sense that they do not provide specific guidelines for concrete projects.

To respond to HE dynamic contexts and emerging needs, *process models* recently emerged as an alternative. According to Dawson *et al.* (2018), these models represent LA adoption as an iterative, continuous process in which both LA deployment and the institutional policy evolve in a coordinated manner. The ROMA (Rapid Outcome Mapping Approach) framework was developed with a focus on evidence-based policy change (Ferguson *et al.*, 2014), and is suggested in prior work as an effective tool to support systematic adoption of LA in HE (Macfadyen, Dawson, Pardo, & Gasevic, 2014). The SHEILA (Supporting higher education to Incorporate Learning Analytics) framework (Tsai, Gasevic, *et al.*, 2018) builds on ROMA and is currently one of the most prevalent examples of process models. SHEILA is a policy framework that consists of an iterative process aiming to guide the development of evidence-based policy through active engagement with relevant stakeholders (Young & Mendizabal, 2009; Young *et al.*, 2014). Recently, and as a result of a large-scale European project in collaboration with Latin America, the LALA Framework was proposed. LALA takes as a reference the SHEILA framework and adapts it to the needs of the Latin American region. Compared to the previous models, process model-based frameworks are better in capturing the complexity of HE dimensions intervening in the definition of strategic policies and LA adoption. However, case studies and practical guidelines about how they can be operationalised at scale are very limited (Colvin *et al.*, 2017; Klein, Lester, Rangwala, & Johri, 2019). Moreover, how the design and implementation of LA tools feeds the LA policymaking process, and inversely how policymaking steers tool design and implementation has not yet been explored.

More studies are needed to understand how frameworks that have recently emerge facilitate the process of scaling up LA initiatives (Tsai, Poquet, Gasevic, Dawson, & Pardo, 2019).

The research question addressed in this paper is: *how can the interaction between policy development and tool implementation for supporting LA adoption at scale be organised?* This study suggests a concrete recommendation on the organisation of LA projects aiming for scalability, coordinating policy development and LA implementation. This will be approached first by analysing two example cases with similar tool implementations, but a different situation regarding the interplay with policy development. Thereafter, a coordination model will be proposed and validated with experts. The contribution of this study is that it provides additional guidance for LA implementations at scale, not by replacing the existing frameworks, but by complementing them with an approach to orchestrate the interaction between the policymaking and implementation. Furthermore, the conceptualisation and validation of the model in a Latin American context may contribute to its applicability in the region.

Implementation cases in Europe and Latin-America

This section presents two cases of LA adoption in HE. One case took place in the KU Leuven, Belgium, the other in the University of Cuenca, Ecuador. Similar LA dashboards were implemented in both universities, but LA policymaking and the actual implementation interacted in different ways. Before going into these cases, we present a timeline commonly used to plan and describe them.

Implementation timeline

The two cases presented below were not detached: KU Leuven and the University of Cuenca were two of the six partners in the LALA Project. As part of this project, some of the LA specialists that participated in the first case were also involved in the second one. In both cases the predetermined end goal was not just to experiment with LA tools, but to establish their deployment at scale, anchored in institutional processes. A similar implementation timeline is used to describe the work in Leuven and Cuenca, consisting of four phases: first an initialisation phase, followed by a prototyping phase, third a piloting phase, and in conclusion a scaling phase. This four-phased approach was shared among all four Latin-American partners in the project. As illustrated in Figure 1, overlap between two consecutive phases is possible. The timeline was introduced to plan for, and report about the implementation effort in the different institutions. It is therefore intentionally defined at a level to allow each of the phases to be specified further to fit selected implementation methodologies.

The contents of each of the phases are as follows.

1. *Initialisation phase*: In the first phase, it is important to create a common understanding of which problems will be targeted and what will be the basic needs for the LA project.

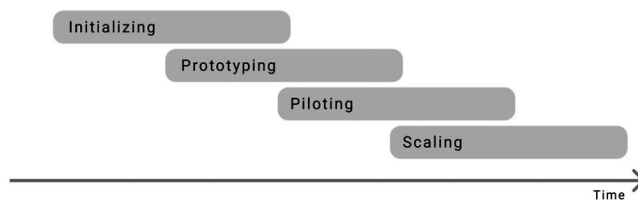


Figure 1: Four implementation phases, which may overlap in time. Each of these phases can be further specified according to the chosen implementation method

A project team needs to be assembled and a summary-level planning should be defined. This phase may include a consideration of the current state of the art, as a source for inspiration and potential reuse.

2. *Prototyping phase:* When prototyping, one or more artefacts are being produced, not with the intention of finality, but as an instrument to support the design activities, discussion and improvement through iteration. Typical activities may include low- and high-fidelity prototyping and several iterations of consulting stakeholders to better elicit requirements and to validate the design choices and assumptions addressed by the prototypes. Carrying on the idea of including state-of-the-art examples, the prototyping phase may also begin with discussing real or mock-up examples of previously developed tools, resulting in a prototype that demonstrates adaptations required for the different context.
3. *Piloting phase:* This phase aims at testing the solution design in a natural setting. It involves the use of real data that will be accessed by the real users in a context that is representative for the intended end goal of the solution. It differs from the subsequent scaling phase in that only a subset of the intended user population is targeted. Piloting too can be organised as a sequence of iterations, to test improvement to the design over time or to gradually add additional participants before moving into the scaling phase. While many concerns should be handled in the prototyping phase, mainly by applying qualitative methods, eg, by conducting interviews and organising focus groups, the piloting phase offers an additional opportunity to test hypotheses in a quantitative way, by collecting usage traces (eg, Broos, Peeters, *et al.*, 2017; Broos, Verbert, Langie, Van Soom, & De Laet, 2017).
4. *Scaling phase:* This last phase starts from what was learned from the previous phases, especially from the piloting phase, to re-implement or at least re-deploy, the envisioned solution at scale. Here the full population is targeted: all intended courses, programmes and faculties. Several challenges related to the scalability of the solution will need to be tackled. This includes, but is not limited to, technical issues, eg, the requirement for system resilience, and maintenance. For the four-phase timeline presented here, it is thus suggested not to overemphasise technical scalability during the piloting phase. Similar considerations remain for other challenges related to scalability, among which the involvement of stakeholders across the institution, the communication process and the perpetuation of the new LA solution.

Next, we describe two cases where these four phases were used to plan and structure their LA implementation process.

First case: KU Leuven

At KU Leuven the Tutoring & Advising department of the Faculty of Engineering Science took the initiative to explore LA to support first year students in the transition to HE. The aim was to complement the existing advising efforts provided by the dedicated educational support staff by cost-efficient, scalable technology-enhanced solutions re-purposing data that were already available in the institution. Three tools were introduced, each presented in more details in previous studies: (1) LISSA, a dashboard to support the interpersonal dialogue between the student and study adviser (Charleer, Vande Moere, Klerkx, Verbert, & De Laet, 2018; Millecamp, Gutierrez, Charleer, Verbert, & De Laet, 2018); (2) REX, a self-service dashboard for students to reflect on their examination study results (Broos, Verbert, *et al.*, 2017); (3) and LASSI, a self-service dashboard to aid students with the assessment and remediation of their study skills (Broos, Peeters, *et al.*, 2017).

Initialisation phase

To understand the requirement of the student advisers in preparation of the LISSA dashboard, a user and task analysis was performed following the guidelines of Sedlmair, Meyer, and Munzner (2012). The aim of this analysis was to understand what information is needed and what aspects of their current experience users value the most, and to get an overview of their further needs and wishes. Similar requirement elicitation was performed with regard to REX and LASSI.

Prototyping phase

The dashboards were created by two closely collaborating teams following a similar user-centred, rapid-prototyping design approach. Several iterations took place, and student advisers, the head of the Tutoring & Advising department, and visualisation experts were included to provide feedback in brainstorm sessions and semi-structured interviews. After several digital mock-ups and functional prototypes, the dashboards were further developed for piloting.

Piloting phase

In the first piloting iteration LISSA was deployed in two programmes. By the third piloting iteration, the availability of the dashboard was extended to eight additional programmes outside of the initial faculty. The dashboards LASSI and REX were piloted using a similar approach. These student-oriented self-service dashboards did not require the same intensive coordination with student advisers, which enabled the inclusion of more study programmes earlier on in the piloting phase. LASSI was first offered to students in 12 different STEM programmes (Broos, Peeters, *et al.*, 2017). Similarly, REX was deployed to 11 participating study programmes (Broos, Verbert, *et al.*, 2017).

Scaling phase

In the next academic year, a scalability round of the three LA tools was initiated, resulting in the involvement of 39 programme-campus combinations, with a total student population of 12,351 students and 116 student advisers trained to use LISSA. However, further scaling of the tools was then put on hold. Notwithstanding positive reactions and scientifically substantiated results, the strategic anchoring of the newly introduced LA practice at the institutional level had shown to be harder than anticipated without an available policy.

Only several months after the deactivation of the dashboards, university leaders proposed a first LA policy direction and an initiative to support the scale-up to the university-wide level. Alongside the rebooted scale-up phase, the policy is being further developed and several decisions regarding further centralised coordination of LA are being taken. The scale-up is currently (December 2019) ongoing, and university leaders have shown strong commitment to making the three dashboards widely available.

Second case: The University of Cuenca

In the past years Ecuador has made important advances in relation to the quality, inclusion and relevance of HE. However, the HE system still conserves deep gaps in its internal structure, for example, how to provide effective and timely help to those students whose performance is below expectations. Supported by the LALA project, University of Cuenca implemented two LA tools: (1) a dashboard to support the advising of students in the first year, inspired by the LISSA dashboard; (2) and a teacher-oriented dashboard to provide insight in grading behaviour and the academic achievement of different subgroups of students. As a result of other work packages in the LALA Project the implementation was executed in parallel with a LA policy and requirements gathering exercise. However, lacking clear guidance at the time, the lines of work did not interact in a coordinated way.

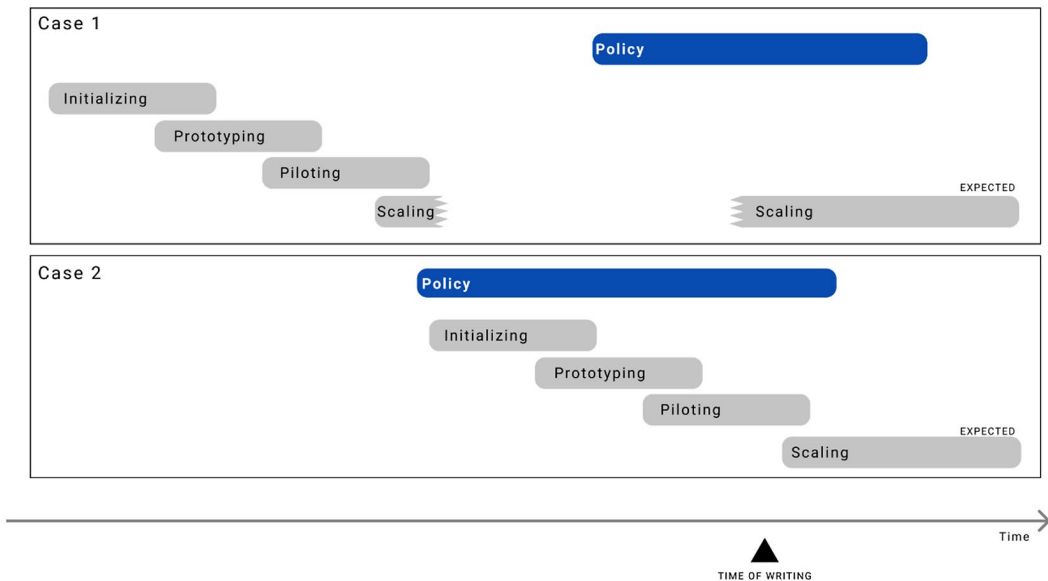


Figure 2: Simplified timeline of case 1 (top) and case 2 (bottom), showing their relationship in time, and for each showing how policy development (blue bars) coincided with each of the four implementation phases (grey bars). The arrow on the time axis shows the situation at the time of writing

Initialisation phase

In previous educational innovation projects in this university, involving stakeholders too late in the process had caused difficulties in acquiring the necessary support. Therefore, and given the novelty of LA for this institution, early identification of relevant stakeholders was considered critical. In a first interview the dean and vice-dean of the Faculty of Engineering were consulted. The IT director of the university was consulted separately. Based on these first interviews, the problem of supporting students in planning of and following up on their study path was selected as a priority for LA.

Second, a group of career chairs was invited to discuss the needs and expectations. The option to create a dashboard similar to LISSA dashboard to support these conversations was further explored. Using a mixed approach combining multiple iterations of interviews and focus groups, a common understanding of what LA could be used for was built. A by-product of these sessions with career chairs who are also teachers, was the identification of a second need: a means for teachers to follow-up on the grades of different subgroups of students within their courses.

Prototyping phase

First low-fidelity prototypes were designed using presentation software. For the advising dashboard the first prototypes were based on screenshots of the LISSA dashboard, gradually evolving into an adaptation befitting the different context; the teacher dashboard started from scratch. After a number of iterations, high-fidelity prototypes were introduced using an online collaborative interface design tool. After several iterations of improving the high-fidelity prototypes with career chairs, teachers and students, interactive mock-ups were shown to the rector of the university. While the rector was previously consulted about his expectations regarding LA as part of the coinciding policy-development, giving a clear preview on what was being developed helped to

steer the conversation. The rector confirmed executive support to the project and framed the use of the dashboards into his wider vision on increasing flexibility for student careers, and how this would impact their need for additional support.

Piloting phase

A first piloting phase targeted a single faculty (Faculty of Engineering). In order to involve actual students, teachers, and career chairs executive approval was required. Being involved in the previous phase and LA policymaking, the rector was in an informed position to provide approval. Paper questionnaires were used to collect information from students and teachers. Several training sessions were offered to career chairs and the grading dashboard was presented to teachers during information sessions.

Scaling phase

At the time of writing (December 2019), the scaling phase had not yet started. The target of this phase is to offer the two dashboards to the entire university. Apart from technical efforts, this phase foresees organising in-depth training sessions for career chairs, and the alignment of counselling processes across different faculties. From the position of the university leaders, it is therefore important to mitigate project risks by learning about problems and dependencies during the piloting phase as much as possible.

Discussion of the cases

Similar LA tools were implemented in two different contexts. In Figure 2 a simplified course of events is shown relating both cases. Both cases followed the summary-level timeline presented in Section “implementation timeline.” The timing of the second case allowed to carry over lessons learnt from the first.

A notable contrast between the two cases is the difference in concurrency with LA policy development. As apparent from the gap between phases in Figure 2 (top part), the first case did not move fluently from the piloting phase into the scaling phase for lack of institutional embedding. Only several months later, when policy development started, the scaling phase was rebooted. In this way, the first case exemplified the need for policymaking to enable a roll-out at scale acknowledged by previous studies.

A different development was observed in the second case. Due to the involvement of the University of Cuenca in the LALA Project with a separate work package about policymaking, the implementation process of the two LA dashboards coincided with this policy-oriented effort. It cannot be claimed that this was intentional, nor that the two processes interacted in a coordinated way. Nevertheless some interaction did take place and its two-way beneficial impact was visible in several ways, eg. ongoing policymaking helped to identify stakeholders and educational needs; concurrence with implementation made it easier to allocate resources to participate in policymaking; and the availability of “tangible” prototypes facilitated further policy-oriented discussion with the rector.

In summary, three main observations from the cases are (1) a fully developed policy was not required to start the implementation; (2) however, without policy, implementation was hindered when attempting to scale up; (3) when policymaking and implementation coincided, they appeared be mutually reinforcing, even if the interaction was uncoordinated. While these observations stem from only two cases, we believe they do invite for further exploration of an optimal coordination of this interaction, which is the subject of the next section.

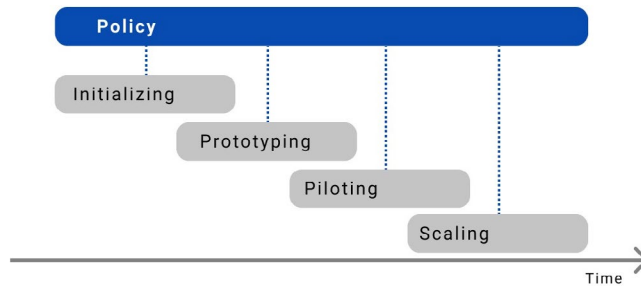


Figure 3: Proposed coordination model. Policy development (blue) coincides with implementation phases (grey), using the implementation timeline to organise the coordination (dotted lines)

Coordinating policymaking and implementation

Process models for institutional LA adoption recognise the relationship between actual implementation and policy, but they are unclear about how to organise this relationship in concrete projects. Notwithstanding the many opportunities for LA in Latin-America, institutions with limited resources and experience may be hesitant to start projects without clear examples or guidance. In the previous section, two cases were presented. The second one strengthened the case for a coordination of policymaking and implementation, which can be mutually reinforcing when happening concurrently.

Coordination model

Responding to the need for concrete guidelines, we propose to underpin this coordination using the implementation timeline, as illustrated by Figure 3. The main features of this proposal are that (1) policymaking does not have to precede implementation, but can happen at the same time, and (2) both efforts can be coordinated. This proposal does not contradict the cyclical, or iterative approach suggested by several process-models in previous studies. It can be seen as a single iteration in such a model, and should be especially useful for the first of such cycles, responding to practitioners' concerns about where to start. For the sake of practical applicability, we have used the timeline presented in Section "implementation timeline" as an example for the coordination model. This summary-level timeline may be further specified according to specific project management approaches.

As a validation of the proposal to use the implementation timeline as a coordination model to connect policymaking and implementation, we conducted an exercise to map the items of a policymaking framework to the four phases in the implementation timeline introduced earlier. The mapping was done using the SHEILA framework, which will be briefly introduced first.

Mapping the SHEILA policy framework

The SHEILA policy framework (Figure 4) was presented as a process model in the Introduction. Relevant to this study is that SHEILA does not propose a definite order for these steps or dimensions. Instead an iterative approach is promoted.

On its website (<https://sheilaproject.eu/>) the project made available a list of 179 concrete items (actions, challenges, and policy) structured along the six dimensions of the framework. For instance, one item under the *challenge* category of the dimension *Identify Desired Behaviour Changes* is "Users may game a learning analytics system." With the third SHEILA edition an online tool "Build your custom framework" was added, making it all the more clear to practitioners that the

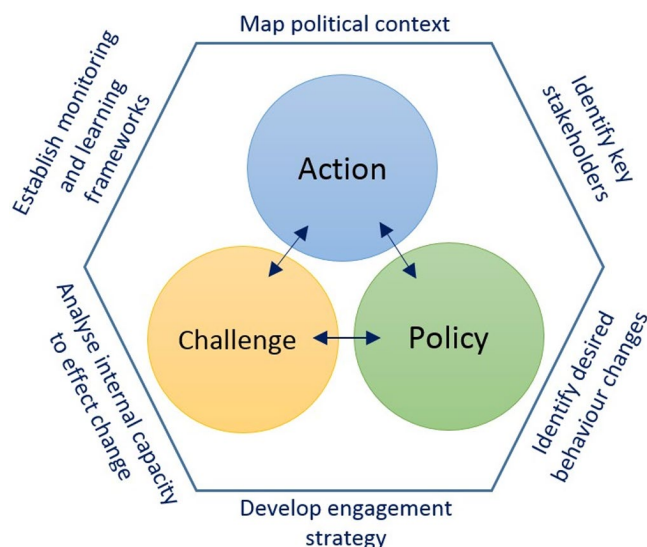


Figure 4: From Tsai, Moreno-Marcos, et al. (2018): the SHEILA framework structure, using six dimensions to categorise actions, challenges and policy. The diagram illustrates the cyclical nature, without a predefined starting point or order

list of items presented is intended as a collection to pick from based on their specific. However, what the tool does not provide is a way to structure the selected items over a timeline.

Consulting a panel of experts, we have obtained a mapping of the actions, challenges, and policies (items) included in SHEILA on the four phases of the timeline presented earlier in this paper. The overall concept of this mapping is depicted schematically by Figure 5. The goal is to verify if the 179 SHEILA items of the six dimensions can be structured over the phases, thereby supporting the potential of the proposed coordination model to coordinate policy-building and actual LA implementations taking place concurrently in an institution. In opposition, if experts would not be able to find some consensus over such a mapping, or if they would map nearly all items to a single (initialisation) phase this would suggest that policymaking should happen separately from, and most likely before an implementation is attempted.

Methodology

To obtain a mapping, a panel of sixteen LA experts was consulted during a two and a half our long consensus-building workshop. This workshop, led by two of the authors, involved sixteen LA experts (seven women, nine men) of six different institutes (two from Chile, two from Ecuador, one from Spain, and one from United Kingdom). Each of the participants was knowledgeable in LA, either from the perspective of research, or from concrete, ongoing implementations within their own institutions, or –in most cases– both. The experts were divided over six groups of two or three members such that each group only contained members from different institutes. In a first phase, the experts were introduced to the four phases of the timeline and the approach of the workshop. Next, each group was asked to obtain consensus on how to map a subset of the SHEILA items to the phases. To this end each group (indicated by *g*) had to answer three questions for each item (*i*):

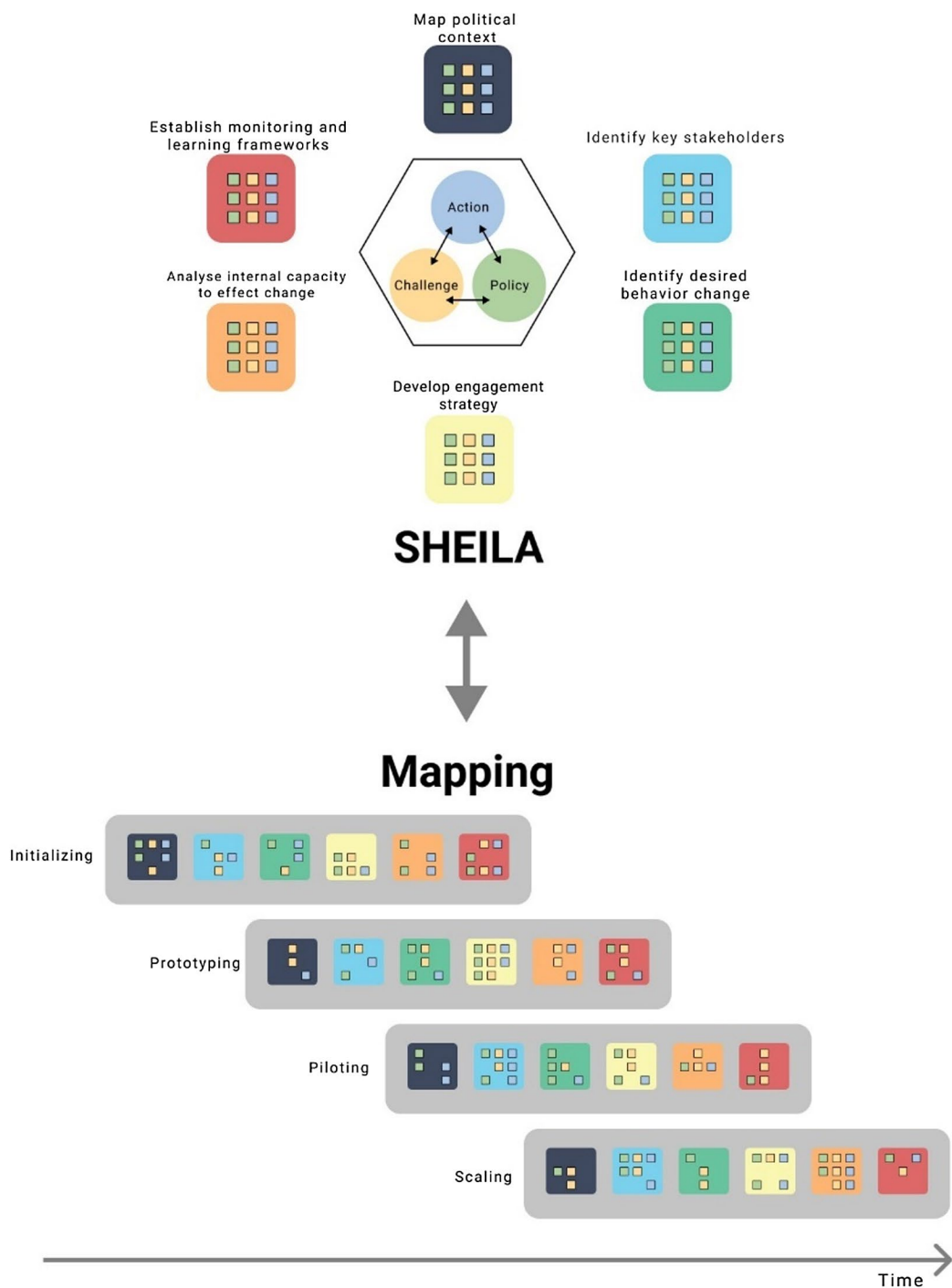


Figure 5: Summary of the mapping activity connecting 179 items from six dimension in the SHIELA framework to the four phase in the framework proposed in this paper

1. How relevant is this item for obtaining *scalable* LA implementations, on a scale from 0 (not relevant at all) to 100 (indispensable) (r_i^j)?
2. If you have to attribute the item to only one of the four phases, to which one would you attribute it (indicated by four binary values a_{ij}^g for each item, with $j \in \{1, 2, 3, 4\}$ indicating the phase, and such that only the phase to which the item is attributed has $a_{ij}^g = 1$ and 0 otherwise)?
3. What is the confidence in your group's allocation of this item (c_i^g) on a scale from 0 (not confident at all) to 100 (very confident)?

The different items were distributed over the groups such that each item was at least mapped by three groups. The results of the mapping were collected by the workshop leaders and further processed to check for consensus among the different groups. The average relevance r_i of and confidence c_i for each item i were calculated as the average of relevances r_i^j and confidences c_i^g assigned by the different groups respectively. To quantitatively assess the consensus, a weighted attribution score w_{ij} for each item i to each of the four phases j was calculated as:

$$w_{ij} = \frac{\sum_g a_{ij}^g c_{ij}^g}{\sum_g c_{ij}^g} \quad (1)$$

Therefore $\sum_{j=1}^4 w_{ij} = 1$ The weighted attribution score w_{ij} combines the confidence of the groups and their attribution to the phases. $w_{ij} = 1$ reflects that the groups obtained consensus of the attribution of item i to phase j .

Results

Table S1 contains the detailed results of the mapping of the 179 SHEILA items to the four phases.

Relevance of items for obtaining scalable implementations

The average relevance r of the 179 SHEILA items was 87.5%, indicating that the experts considered the items relevant for obtaining scalable LA. Only ten of the 179 SHEILA mapped items obtained an average relevance r_i lower than 75%. For instance, experts attributed only limited relevance ($r_i = 53$) to the challenge “2018 GDPR requires change in existing practice and systems...,” which might point to a contextual difference on this matter between the European background of the framework (GDPR applies to EU residents) and the mostly Latin-American panel of experts consulted.

Confidence of mapping

On average groups had a high confidence (average of 79.9%) to attribute the items to one of the phases. 141 items (79%) were attributed with a confidence equal or higher than 75%. The lower confidence of the remaining 38 items shows that the expert groups were not confident to attribute these items to one or more phases. For instance, the experts found it relatively easy ($c_i = 90$) to map the action “Invite teaching staff to contribute their professional knowledge to the design and in implementation of learning analytics...” to the prototyping phase, but difficult ($c_i = 50$) to decide if the action “Engage with research projects locally or through collaboration with other institutions” best coincides with the initialisation, prototyping, or scaling phase.

Attribution to different phases

The groups attributed 29% of the items to the initialisation phase, 26% to the prototyping phase and to the piloting phase, and 20% to the scaling phase. When each item was attributed to phase j with maximum attributed weight w_{ij} , 32% of the items were attributed to the initialisation phase, 28% to the prototyping and piloting phases, and 12% to the scaling phase, as shown in Figure 6.

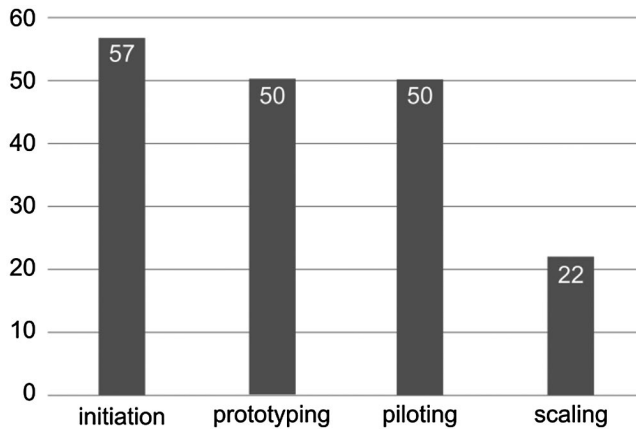


Figure 6: Allocation of 179 SHEILA items over four phases according to six groups of experts. Experts did not allocate all items to the first phase, which supports the idea that policymaking and implementation can be take place in parallel

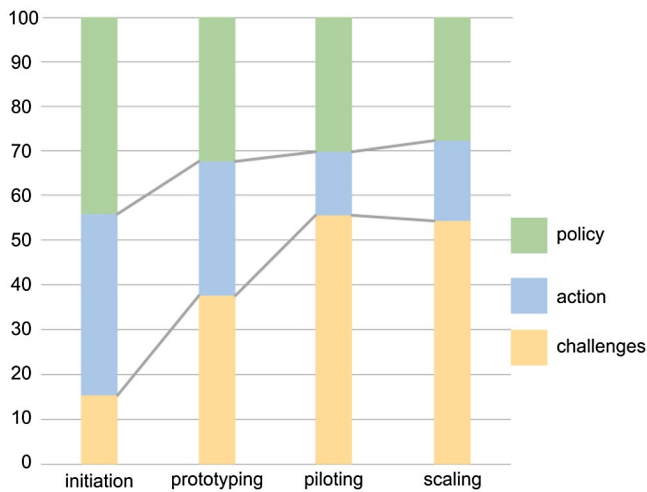


Figure 7: Distribution of 179 SHEILA items over four phases according to six groups of experts structured along the three key elements (policy, action, and challenges) of the SHEILA framework. The figure shows that the spreading of items applies to the three types, but policy and action items seem to be more predominant in the initialisation phase

The above results indicate that small groups of experts can successfully distribute the low-level items of the SHEILA framework over the four proposed phases of the implementation timeline. While the initialisation phase contains most items (29%), many other items can be considered in later stages.

Figure 7 shows how the items are spread over the phases when considering the three key elements of the SHEILA framework (action, challenge and policy), while Figure 8 shows the distribution over the six SHEILA dimensions. Policy and action items are more predominant in the initialisation phase, ie, early in the process towards scalable LA. Items related to challenges moreover are

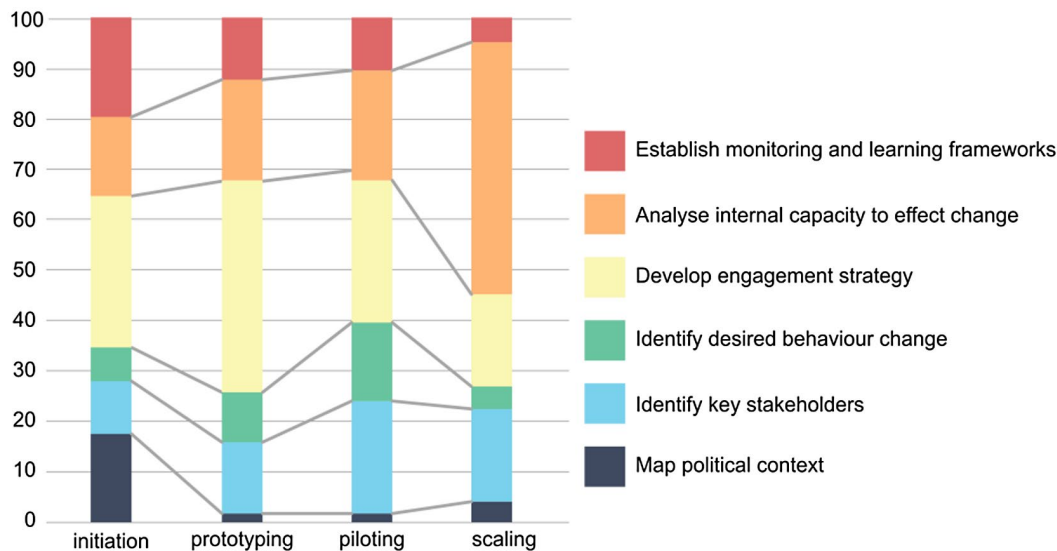


Figure 8: Distribution of 179 SHEILA items over four phases according to six groups of experts structured along the six dimensions of the SHEILA framework. The figure shows that the weights some dimensions are heavier in the early phases, while the reverse is the case for other. Half of the dimensions do not have a predominant phasing

more predominant in the scaling phase, ie, more towards the end of the process. Regarding the six dimensions, the weights of “Map political context” and “Establish monitoring and learning frameworks” are heavier in the early phases, while the reverse is the case for “Analyse the internal capacity to effect change.” The other three dimensions do not have a predominant phasing.

Of the 141 items that the groups attributed with a confidence equal or higher than 75%, 31 items (22%) were attributed to the same phase by all groups (consensus), 84 items (47%) were attributed to two phases, of which 43 items (30%) to neighbouring phases and 26 items (18%) were attributed to three phases. For the 38 items users with a confidence lower than 75%, three items were still consistently attributed to one phase by the three involved groups, 29 items were attributed to two phases (of which ten items to two neighbouring phases).

Discussion of the mapping

The mapping shows that expert teams with members of different institutes including four from Latin America could successfully phase policy building using an existing framework over time. While the weight of policy building is stronger in the initialisation phase, the mapping shows that many items can also be postponed to later phases. The findings suggest that policy building can be distributed over time, that it may happen simultaneously with LA implementation at scale, and that both efforts can be coordinated. The distribution over time allows higher education institutions (HEI's) to take evidence from ongoing LA implementation initiatives into account while formulating policy. Consequently, such implementations do not require a completed LA policy before starting. Spreading out some of the policy efforts can foster a more efficient cross-fertilisation with implementation efforts. While the experts attributed many items with confidence to a single phase, the number of items where they doubted between two neighbouring phases was the highest. An explanation may be that these items should indeed be coordinated with both phases, or that they are most relevant when moving from one phase into the other.

Conclusion

This study showed that while policy development is an important element for HEI's aiming for adoption of LA at scale, it does not necessarily need to precede an actual implementation. In fact it can be distributed over time, partly or completely coincidental with such implementation, and the interaction between both efforts can be coordinated in an efficient way.

One limitation of this study is that it identified the need for additional guidance for the coordination of LA policy development and implementation at scale based on the observation of no more than two cases. However, we argue that these cases are still exemplifying a gap that was made apparent in previous studies (eg, Dawson *et al.*, 2019; Viberg, Hatakka, Bälter, & Mavroudi, 2018). The relevance of the first case here is mainly in its initial failure to scale. The second case applies lessons learnt from the first, and anchors the study in a representative Latin-American context.

Another limitation is that the coordination model was only validated with experts, lacking additional empirical testing under realistic conditions. Here we recognise an opportunity for future research, once more projects aiming at LA solutions at scale have taken place. At the same time, it is our opinion that the model does not contradict the guidelines accompanying previously published frameworks. Instead it adds some concrete advice on how to start working with these frameworks and how to organise them in a situation where concrete implementation of LA at scale is also aimed for. At any rate, the goal of this study was not to compose an absolute ordering for the items in the SHEILA framework, but rather to substantiate the coordination model as a whole. In practice HEI's should repeat the mapping exercise within their own context, if necessary, replacing the policy framework or implementation timeline by one that is most suited in their environment. Accordingly, the proposed model may be usable outside of the specific context of HE the policy-framework used in this study focuses on, eg, in K12 or vocational education. It may be interesting to study and compare the outcomes of similar mapping exercises in these different contexts, possibly using different policy frameworks or timelines.

For resource-constrained Latin-American HEI's operating in a context with limited LA experience, the model may provide support in the difficult undertaking of creating a LA policy, by tapping into the momentum created by a more tangible implementation process. The proposed coordination model provides an actionable approach by promoting the implementation timeline to be the backbone of the interaction between policy and implementation. Institutions in other places of the world may recognise similar conditions and also benefit from this study. On a more general level, we hope that our study contributes to a further reduction of the gap between the research-oriented perspective on LA, and the requirement for more concrete guidelines in real projects. To close the loop, further research should also take the lessons learnt from such projects into account.

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Statements on open data, ethics and conflict of interest

Aggregated data is available in Table S1. Source data can be provided on motivated request after removal of personal identifiers.

The study was undertaken in line with the ethical procedures and guidelines of KU Leuven. Participating experts were informed, and consented to the goal, setup and data processing for this study.

No conflict of interest has been identified.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.