DojoAnalytics: A Learning Analytics interoperable component for DojoIBL

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ABSTRACT

DojoIBL[1] is a cloud based platform that provides flexible support for collaborative inquiry-based learning processes. It expands the learning process beyond the classroom walls and brings it to an online setting. Such transition requires teachers and learners to have more means to track and to follow up their progress. Learning Analytics dashboards provide such functionality in form of meaningful visualizations. In this paper we present the DojoAnalytics, a new module of DojoIBL that enables connections with third party Learning Analytics dashboards. In order to demonstrate interoperability with the external dashboards, two use case implementations will be described.

KEYWORDS

Inquiry-based learning, learning analytics, interoperability, learners' performance

1 INTRODUCTION

The Community of Inquiry (CoI) framework [10, 17] has defined collaborative Inquiry-based learning (IBL) processes as a continuous exploration of a topic, in which learners engage in social interactions to generate shared understanding. To provide support to these collaborative processes, the DojoIBL platform [27] has been developed. It is an interoperable and cloud-based solution that provides to the teachers and to the students a flexible way to orchestrate, organize and communicate within their inquiry community. DojoIBL supports these communities in two ways: facilitating a seamless support of the inquiry learning process, and connecting inquiry learning activities inside and outside the

classroom. It is also a reference point for the members of the community to exchange, share and discuss content. The use of tools like DojoIBL, that can also be accessed through mobile technology, expands the learning process beyond the classroom walls and brings the discussion to the online environments. This transition requires specific technical support to monitor and to visualize students' performance. Students need more scaffolding and means to reflect upon their progress, and the teachers need more control about group and individual performance of the students.

In order to provide means for further reflection for students and more control for teachers, DojoIBL integrates Learning Analytics (LA). Since DojoIBL does not offer this functionality on its core components, we need to interoperate with other third party solutions that offer LA dashboards. Thus, this manuscript presents DojoAnalytics, a component that works as a proxy to exchange information with external LA dashboards. Enabling this exchange of information, however, requires interoperability. This term is described in the IEEE glossary[2] as the ability of a system to work with other systems without special effort on the part of the customer and through the implementation of standards.

Taken together, this study seeks to demonstrate interoperability between DojoIBL and other third-party systems like: Lemo Tool –a Learning Analytics dashboard– and the Learning Locker –a cloud based Learning Record Store–. The Lemo Tool is a standalone platform that provides LA and visualizations for Learning Managements Systems (LMS). The Learning Locker is a massive scalable database to store, analyze and visualize learning data.

To this end, the study is structured as follows. First, the reason of adding a new interoperable component to support Learning Analytics in DojoIBL is presented. In section two, the DojoIBL platform, and the theoretical background of DojoIBL and LA are described. Next, in section three, the technical architecture and its new DojoAnalytics component are described from a macro, mezzo and micro level perspective. Section four demonstrates

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[2] https://www.ieee.org/education_careers/education/standards/standards_glossary.html#Interoperability

DojoAnalytics interoperability by describing two use case implementations with third-party systems. Last, the limitations and conclusions around these integrations are described.

2 BACKGROUND

2.1 Communities of Inquiry

The notion of Communities of Inquiry (CoI) was first used by Pierce to refer to a group of individuals employing interpersonal methods for arriving at results [20]. Since then, many authors have adopted and embedded this concept into social studies in education [17]. For instance, the Knowledge Building approach defined learning as an unpredictable process of generation of ideas within a community of learners [4, 6]. In the context of inquiry-based learning, this concept of community transforms the learning process into a co-construction of knowledge in order to achieve understanding around a shared question. The Knowledge Community and Inquiry (KCI) model [24–26] defined inquiry as the collective process of advancing teachers and students' knowledge and understanding, through the negotiation of their learning goals. In this study, the term Community of Inquiry will refer to a community (of learners) engaging in social interactions (face to face or online) in order to generate shared understanding of a topic of their interest [10, 19, 20].

Under the umbrella of the Communities of Inquiry framework, several authors defined what they called three essential components to an educational transaction. First, the social presence [21] is defined as the ability of the learners to position themselves in the community of inquiry and develop socially and affectively. Second, the cognitive presence [11] describes the learners' capacity to construct and confirm knowledge through sustainable communications with the other members –learners– of the community of inquiry. Last, the teaching presence [2] relates to the process of giving support and direction along the learning process in order to achieve the desired learning outcomes. More recently, the metacognitive aspect has been addressed from the perspective of the CoI framework [1]. Although it has not been included in the main framework, we take into account due to its relevance provide knowledge, awareness and strategies to reflect upon their own learning processes.

2.2 DojoIBL

DojoIBL[3] [27, 28] is a cloud based solution that provides flexible support for activity-based methodologies like inquiry-based learning. It can be accessible from both mobile technology and desktop devices. DojoIBL structures communities of inquiry and provides means for teachers and students to easily orchestrate and organize these communities. DojoIBL has been designed upon four essential pillars to any learning process based on ill-structured activities [15, 22]: flexible structural support, orchestration and group management, learners' awareness and monitoring and time management.

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[3] https://dojo-ibl.appspot.com/

2.2.1 Flexible structural support

Scientific inquiry in empirical sciences answers complex questions following step-by-step processes. In inquiry-based learning, the learners, guided by their teachers, follow existing inquiry models to support their inquiry processes. Tools like DojoIBL, help them to visualize those inquiry processes. In the case of DojoIBL, the inquiry process is organized in phases and inquiry activities (see Figure 1). The phases arrange the inquiry activities together, and the inquiry activities define what the students need to do. In inquiry-based learning, there is a large number of inquiry models defined in the literature [18], and certainly many more will be created. DojoIBL provides a flexible way to support any type of inquiry structure. Figure 1 shows the dashboard for editors in which they can add (green button) and remove (red button) phases, but also add (yellow button) inquiry activities. DojoIBL also includes a catalogue with inquiry models extracted from literature. Thus, teachers starting with IBL can have some initial guidance, while more advanced teachers can explore their own inquiry structures.
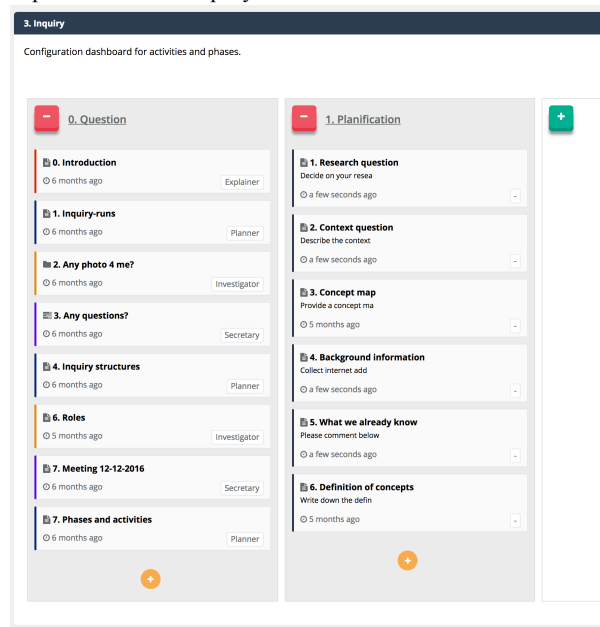
Figure 1: Student's view of three phases and the activities of an inquiry structure.

2.2.2 Orchestration and management

Having multiple inquiry structures requires a lot of management and orchestration effort for the teachers. Enabling an efficient teaching presence [2] is one of the goals of DojoIBL. To cope with this, DojoIBL separates the inquiry structures, that contain the inquiry activities and phases, and the inquiry groups that contain the participants (teachers and students). This provides management power to the teacher to provide the same inquiry structure to different inquiry groups. An inquiry structure can allocate an unlimited number of inquiry groups working independently from each other, i.e.: sending messages, posting comments, visualizing their own timeline, etc. To simplify the

process of assigning students to inquiry groups, each new inquiry group comes with an inquiry code that is used by users to join the inquiry.

The integration of LA can be especially suitable for teachers to enhance orchestration and management of the inquiry processes. LA can help teachers to visualize learners' performance in the different inquiry groups, giving them the opportunity to provide guidance to the learners exactly when is needed it. It also provides options for teachers to reflect about the effectiveness of the inquiry activities, because they can visualize their usage across the different inquiry groups.
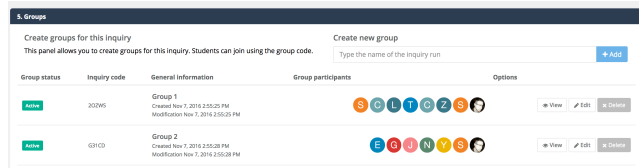

Figure 2: List of inquiry groups for one inquiry structure.

2.2.3 Learners' awareness and monitoring

Inquiry-based learning is based upon the concept of communities of inquiry. Therefore, the learners must have opportunities to collaborate efficiently. Learners need to communicate and to be aware of both, the changes in the inquiry structure and in the inquiry group. For this reason, DojoIBL implements a powerful notification system that increases learners' awareness about the inquiry process. Both the chat messaging and the timeline rely on the notification system. On the one hand, chat messaging enables instant communication among the participants of the inquiry group, and it supports the social [21] and the cognitive [9] presence in the inquiry community. On the other hand, the timeline organizes the most recent contributions within each inquiry group. The timeline is also helpful for teachers to monitor learners' progresses. An implemented filter enables teachers to focus on one student at the time and visualize his/her individual activity on the timeline.

Within the context of Communities of Inquiry, exchanging messages among participants in the communities is key for a fruitful co-creation of knowledge [12]. LA can provide means for gaining more knowledge about the social presence involved in inquiry the inquiry processes. It offers both, qualitative analysis, like i.e. social learning analytics [23] or social network analysis that show a summative visualization of social interactions during an inquiry process. All in all, LA can help to understand the social presence [21] of an inquiry community better.
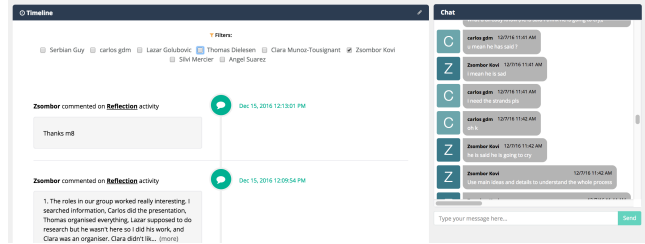

Figure 3: Left: Timeline show the last comments. Right: Chat messages sent to the inquiry group.

2.2.4 Time management

In methodologies based on ill-structured activities like inquiry-based learning, it is essential to help learners to make an efficient use of their time. For this reason, DojoIBL has integrated a calendar functionality that shows the activities that are due soon. Although different inquiry groups can share the inquiry structure, each inquiry group can set its own deadlines for activities. This means that even though they use the same inquiry structure, groups can work at a different pace. This concern about learners' time management, can be further supported with the integration of LA. It can give important information to the learners and the teachers to identify inefficient use of the time during the inquiry process. LA provides a point for reflection, in which the expected and the actual progress can be compared. The progress can be defined as number of activities move the completed and checked by the teachers or facilitator. This point for reflection can support the metacognitive aspect.
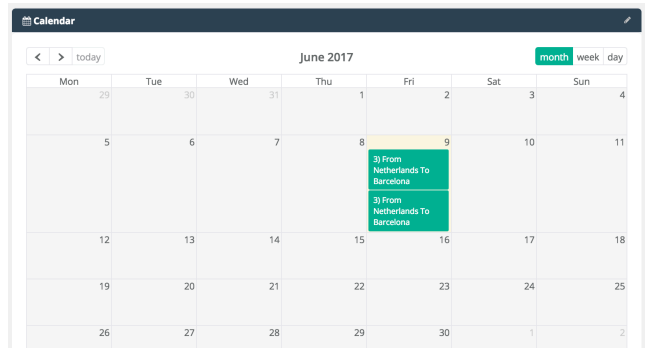

Figure 4: Two activities in the group calendar.

Overall, during the last year DojoIBL has followed a design based research approach in close collaboration with schools and teachers. It has been used in 10 national and international projects by more than 250 users that generated over 2000 contributions and more than 4200 messages. However, in most of the scenarios the lack of a comprehensive overview of the inquiry processes was pointed out. This, together with the discussed potential of LA, the increasing adoption of DojoIBL to support communities of inquiry and the feedback given by users, encouraged the integration of Learning Analytics in DojoIBL.

2.3 Learning Analytics (LA)

The NMC Horizon Report: 2013 Higher Education Edition[4], suggests that Big Data when discussed it in an educational context becomes Learning Analytics (LA). LA is a process that involves the harvesting, preprocessing, modeling, visualization and prediction of future states of an educational situation [29]. LA has been defined as the process of collecting traces that learners leave behind and using them to improve learning [16]. However, to enable such collection and improvement of learning through Learning Analytics, three main elements are required. First, there is need to have a source system that logs users' traces. This can be an online learning platform, like DojoIBL, or a wearable device to collect multimodal data, like Fitbit[5]. Second, these traces need to be stored properly in a repository for learning records, called Learning Record Store (LRS). A LRS is a massively scalable database designed for allocating large amounts of learning experiences. A learning experience is a learning moment that is defined following the xAPI[6] specification as: Actor, Verb, Object and Result. This xAPI specification is an interoperable learning technology that describes communication about learners' activities and experiences between different technologies. Currently, one of the biggest concerns in xAPI is the lack of syntactic and semantic interoperability. A recent study [5] advocates the need to implement standards to have international shared definition of the xAPI specification. Additionally, the study presents a set of best practices and design patterns in form of xAPI recipes. Third, in order to inform the final users in a readable way, why the LA dashboards are needed. They convey to the final user a comprehensive visualization of the learning experiences. Very often, graphs and interactive widgets for filtering and sorting are also embedded in the visualization to facilitate interpretations.

All in all, given the context of the communities of inquiry supported with DojoIBL and the potential of LA to better support and understand these processes, this study addresses the following research question: How can interoperability with external third-parties be achieved, so that LA could further enhance the support of Communities of Inquiry through DojoIBL?
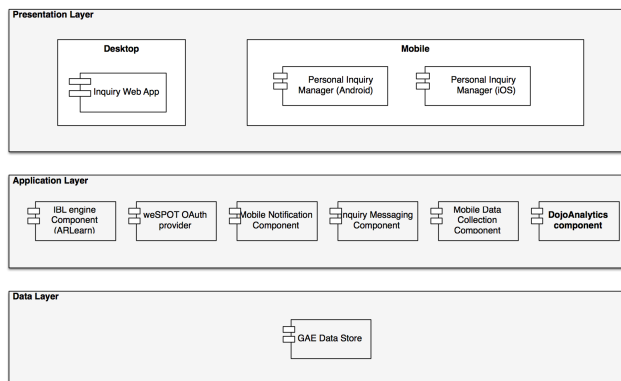
3 ARCHITECTURE

This section describes the DojoIBL cloud based architecture and introduces its new DojoAnalytics software component. The section is organized in three parts according to the macro, mezzo and micro levels of abstraction of the architecture. These levels are not related to the concepts used in Learning Analytics, they refer to the level of granularity while describing the architecture. The first part focuses on the anatomy of current DojoIBL architecture and how the new DojoAnalytics component is placed on the architecture. So it provides the macro level perspective of the architecture. The second section provides a mezzo level perspective and it focuses on the relationship of DojoAnalytics

with the rest of the software components. Finally, the lower level of abstraction is provided in the micro level, in which the xAPI semantic and syntactic specification are described.

3.1 DojoIBL architecture – Macro level

The DojoIBL architecture is organized in three layers (Figure 5). First, the 'presentation layer' (or frontend) is the user interface. It provides three entry points for users to interact with the DojoIBL functionality; a web-browser application and two mobile applications. This layer centralizes all users' requests and forwards them to the suitable services on the 'application layer'. The 'application layer' is built upon components following a SOA (Service Oriented Architecture) software design [7] that provide discrete units of functionality. This layer –application layer– independently coordinates users' requests, from the different entry points, and process them to give back the requested services. Last, the 'data layer' implements the mechanisms to retrieve and to store information in the database.

Figure 5: The three layers of the DojoIBL architecture: Presentation Layer, Application Layer and Data Layer.

The 'application layer' in DojoIBL is built upon separate software components that provide functionality to support collaborative inquiry-based learning. Central to this layer is the 'IBL engine' component that is responsible for managing the inquiry structures, the inquiry groups and the inquiry activities. Whenever a user performs a CRUD operation (Create, Read, Update and Delete) over one of these elements, a learning statement will be captured and sent by DojoAnalytics to the third-party system. Next to the IBL engine, there are four components offering services for authentication, communication, data collection and notification. All of them, besides the notification one, are connected to the DojoAnalytics component. When a student collects a picture to an inquiry activity, or sends a message to an inquiry group, the DojoAnalytics captures that learning experience through its API. The interface of the API and its functionality will be described as part of the mezzo perspective level, in the next section.

3.2 DojoAnalytics context – Mezzo level

The DojoAnalytics is a new software component added to the application layer of the DojoIBL architecture. It is responsible for capturing the users' interactions and for the submission of the corresponding learning experience to a third-party solution. Figure 6 shows a detailed overview of the application layer. It shows the connections between the existing software components and DojoAnalytics. Besides the 'Notification' component, all the components are subscribed to it in order to register users' actions.
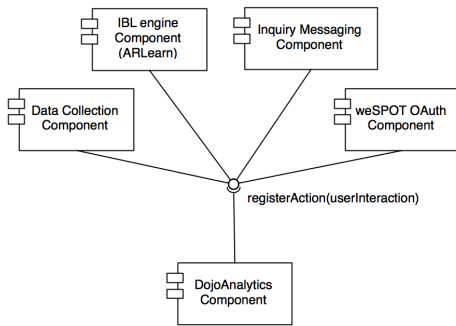
Figure 6: Software component diagram depicting how the DojoIBL components are wired together.

To enable the communications with other components, the DojoAnalytics comes with an internal API with two methods: *registerStatement* and *submitStatement* (see Table 1). These methods are encapsulated into the *DojoAnalyticsDelegator*, and their role is to allow other components registering and submitting users' actions to third-party system (i.e. learning analytics dashboards or learning record stores). As a user performs an action in DojoIBL, the corresponding component uses the API request –*registerStatement*– to send the data to the DojoAnalytics component. The *registerStatement* method receives three Strings with the essential information needed to describe a learning statement (an *actor*, a *verb* and the *object* towards the actor is working to), and it dynamically instantiates and invoke the different *submitStatement* methods for the different system visualizations. As an interoperable component, DojoAnalytics must be able to submit statements in a xAPI format to any third-party system. In turn, each third-party system connected to DojoAnalytics must have a specific implementation of the *submitStatement* method. This is because each system has its own authentication requirements. Nevertheless, although the implementations can be different the syntactic and the semantic xAPI specification must remain the same. In the next section, this specification will be explained.

Table 1: Internal DojoAnalytics API to communicate with the rest of the components in DojoIBL.

Register Statement	
Description	Enable the registration of an action. To simplify the process, the object contains fields corresponding to an xAPI statement.
Method	*registerStatement*
Parameters	Actor: String Verb: String Object: String
Submit Statement	
Description	Enable the submission of statement to external parties. It requires an xAPI object and the identifier of the Learning Record Store towards the statement is being submitted.
Method	*submitStatement*
Parameters	Actor: String Verb: String Object: String

3.3 DojoAnalytics component – Micro level

Although the structure of an xAPI statement (actor, verb, object, context and result) is already pre-defined by the technical specification, the syntax and the semantic recently raised some criticism [3]. There have been some authors that suggesting recipes to overcome the criticism [3, 5]. In an attempt to follow their advice, table 2 presents the first draft of the learning experiences covered by the DojoAnalytics. For the reader visibility the CRUD (Create Read Update and Delete) operations have been combined into single rows.

The xAPI specification for DojoAnalytics contains 19 possible learning statements that define the possible learning experiences with DojoIBL. Every software component defined in the macro level section has a set of related learning statements. The IBL engine has 15 statements that keep track of users' actions on inquiry structure, group and activities as well as joining an inquiry group and comment in an inquiry activity. The messaging component and the authorization component keep track of the messages sent to an inquiry group and the users register to DojoIBL respectively. Similarly, the mobile data collection component has 2 learning statements that keep track users sharing and deleting multimedia artifacts (video, image or audio).

It is a good practice to reuse vocabulary in xAPI specification, so we have followed Berg's vocabulary [5], in order to contribute to the international definition of usage of xAPI specifications. However, since Berg's and our context are slightly different, we chose to extend it with verbs join.

Table 2: xAPI specification for DojoAnalytics.

xAPI semantic	xAPI syntax
CRUD operation on an inquiry structure	Actor: Teacher Verb: Create/Read/Update/Delete Object: Project Context: Time Result: -
Creating (CRUD) an inquiry group	Actor: User Verb: Create, Read, Update, Delete Object: Group Context: Time, Project Result: -

Adding (CRUD) an inquiry activity	Actor: User Verb: Add, Read, Delete, Update Object: Activity Context: Time, Phase, Project Result: -
Join an inquiry group	Actor: User Verb: Join Object: Group Context: Time, Project Result: -
Comment (CD) on inquiry activity	Actor: User Verb: Comment Object: Response Context: Time, Group, Activity Result: Comment text
Send a message to an inquiry group	Actor: User Verb: Send Object: Forum Message Context: Time, Group Result: Message text
Collect (D) a multimedia artifact	Actor: User Verb: Shared Object: audio/video/image Context: Time, Group, Activity Result: Multimedia artifact
Register a new user	Actor: User Verb: Registered Object: Page Context: Time Result: -

4 USE CASE IMPLEMENTATIONS

This chapter presents two use case implementations to demonstrate interoperability between DojoIBL and third-party LA systems through DojoAnalytics. The first scenario describes the integration with Learning Locker, an open source LRS (Learning Record Store) that is used to store, sort and share learning statements. The second scenario covers the integration with the Lemo Tool, a standalone Learning Analytics Dashboard that provides similar, but more suitable, functionality than Learning Locker. Both scenarios will describe the default sequence of the data since the users perform the actions in DojoIBL until the system visualizations display the information accordingly.

4.1 Scenario 1: Learning Locker

A Learning Record Store (LRS) is a massively scalable database for storing learning activity data. The Learning Locker (LL) is a LRS that is available as open source, to be hosted by users, and as Software as a Service (SaaS), hosted by Learning Locker as cloud based solution. The LL provides users with a tool-suite to store, sort and share data from multiple sources and to process it to make inform decisions about learners' future learning processes. The LL is one of the most installed LRS. It provides a user-friendly environment that consumes xAPI learning statements, good and clear data management process and

very powerful visualizations. The LL allows users to have multiple LRS in the same installation and provides a very intuitive users' management interfaces for crossed analysis from different data sources. From a data analysis perspective, it comes with a set of pre-defined graphs and customizable dashboard that can be adjusted by the user using the drag and drop interface. LL also allows users to export results in JSON or CSV format.

For this particular scenario, an instance of Learning Locker has been installed in a Mac OS X local environment. Since LL is built upon the Laravel PHP framework, a MAMP (Mac OS, Apache, MySQL and PHP) solution that provides an apache web server was used. Additionally, a MongoDB database and a MongoDB PHP extension for PHP 5.6 have been installed as part of the installation requirements.

The LL functionalities for the end user provide a meaningful support for metacognitive processes. The reports and the filters allow users to zoom in and create personalized reports to focus only on specific parts of the inquiry process. The users can follow the progress of a specific inquiry group, check the frequency of learners' responses or analyze the effectiveness of an inquiry activity across various inquiry groups. Figure 7, for instance, shows an example of the number of messages sent in an inquiry group during a week. This information by itself might not be relevant. However, combining the visualizations with the learning experiences defined in the micro level section, it provides a reliable overview of learners' performance. Thus, it can be helpful for teachers to follow up and to monitor students while they work in DojoIBL beyond the classroom walls. Moreover, it can also be useful for learners to critically assess their own performance. They can judge the strategies applied during the inquiry activities or reflect upon their progression or stalling (Monitoring of Cognition) [1].
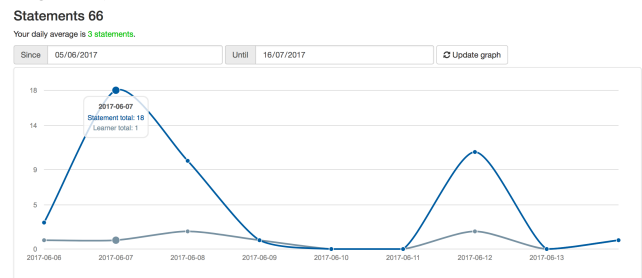

Figure 6: Example of a Learning Locker visualization.

However, the LL does not provide support through the API to retrieve the visualizations and embed them directly into the DojoIBL platform. Although the reports can be retrieved in JSON format via the LL API, displaying the information in a readable way will require the use of visualization libraries like D3.js[7]. Therefore, the next scenario introduces an alternative that allows for more flexibility on the visualizations.

4.2 Scenario 2: Lemo Tool

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[7] https://d3js.org/

The Lemo Tool [8] is an open source web based learning analytics application developed by the HTW (Hochschule für Technik und Wirtschaft Berlin University of Applied Sciences). Compatible across different learning management systems (LMS), the Lemo Tool collects traces from the users and visualizes activity data to help identifying and visualizing users' trends, needs and frequent learners' path. The aim of the Lemo Tool is to provide support for evaluating research hypothesis, educational issues and users' behavioral patterns. It is offered through a user friendly interface, and provides different types of visualization, like i.e.: activity graphs and frequent learning paths.
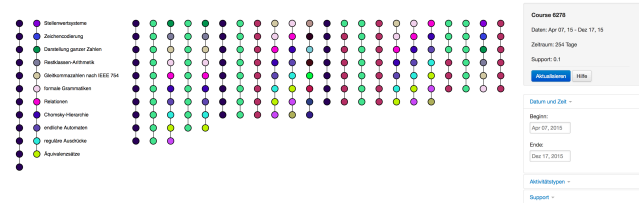

Figure 8: Learning path visualization in Lemo Tool.

As shown in figure 8 the most frequently used learning paths can be visualized side by side for a better comparison. At the moment missing but planned and currently developed is the visualization of a desired learning path from the teacher's perspective with a more intuitive experience as shown in Figure 9.
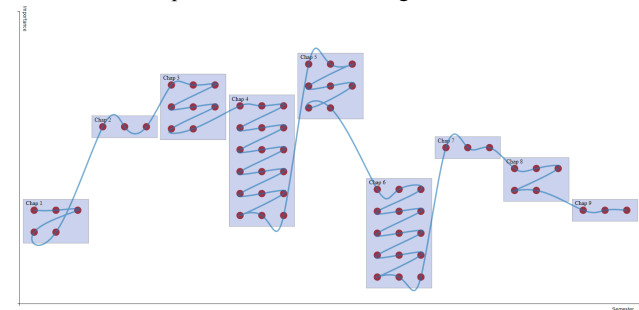

Figure 9: Desired learning path.

Integrated in a learning environment this visualization can help finding student outliers or structuring future inquiry projects.

In the context of the LA4S project [13], an interface between DojoIBL and the Lemo Tool was designed. The goal was to provide the learners and the teachers with information that help them to understand more about their learning processes. Figure 8 shows the UML component diagram of the external Lemo Tool interface that enables the integration into learning applications like DojoIBL. On the DojoIBL side there are three components: The DojoAnalytics and the OAuth component in the application layer and the frontend component in the presentation layer. In the Lemo Tool side, there is one module that provides all the functionality. Because of privacy issues the communications among both platforms need to be authenticated to protect the data exchanged. Only the visualization framework data does not require authentication (sending and receiving the type of visualization, not the visualization data that DojoIBL users want to use).
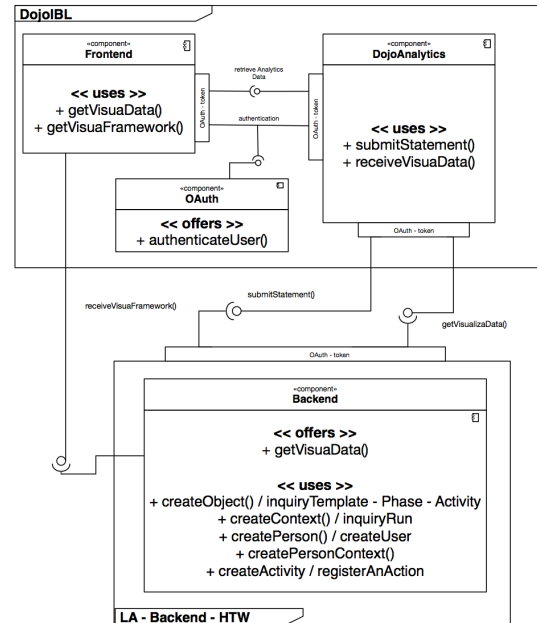

Figure 10: Architectural disposition of both backend.

This integration between DojoIBL and the Lemo Tool offers more personalized control and monitoring over the learners' progress. This is because the Lemo Tool e.g. focuses on visualizing Learning Paths. A learning path is defined as a "set of one or more learning actions that help to achieve particular learning goals or competence" [14]. Therefore, the aim of the Lemo Tool is to display the steps needed to achieve specific learning goals or competences. However, one of the weaknesses of the learning path model is the lack of granularity, especially when it comes to define these learning actions.

The integration with DojoIBL and the use of xAPI, is a suitable complement to provide the missing granularity. On the one hand, the use of xAPI statements provide more detailed information about the steps taken by the learners during the inquiry process. On the other hand, the DojoIBL infrastructure (inquiry structures and inquiry groups) provide means to enable different groups of learners working towards the same goals. Thus, taken together, visualizing the learning paths of the different inquiry groups can provide most frequent paths taken for the learners to arrive to their goals. Furthermore, analyzing all learning paths from all the inquiry groups, the most successful inquiry activities can be extracted, which provides more insights for the teachers to design better inquiry processes.

From the community of inquiry point of view, the integration of Lemo Tool and the visualization of learning paths provide means to identify more accurately the cognitive [11] and social presence [21]. This approach opens up possibilities for future research about personalized learning, since a better relation can be established between the students' interactions with DojoIBL, the learning objectives achieved and the inquiry activities used in the process.

5 CONCLUSIONS

Technology has contributed to enable better support for collaborative (mobile) learning methodologies -like inquiry-based learning-. The DojoIBL has helped to expand the learning processes beyond the classroom walls bridging the gap between formal and informal learning. It also has facilitated ubiquitous discussions in which members of the community co-create knowledge through the mobile technology. This transition, from the traditional setting to the online digital environment, requires more teachers' presence [2] and higher control over the learning process. The higher control over the learning process can be achieved with the integration of an external Learning Analytics dashboard that provides ways for the learners to reflect upon their learning, and tools to better monitor learners' activity for the teachers.

This study presents DojoAnalytics, a component for DojoIBL to connect with external third party Learning Analytics dashboard. It provides an interoperable bridge with external tools to facilitate students monitoring and foster more reflection about the process. The aim of this study is to demonstrate the DojoIBL interoperability, so that it can better support Community of Inquiry processes. To demonstrate the DojoIBL interoperability, we have described two use case implementations. The first example with Learning Locker provided an intuitive data workflow and a well-documented API. The result is a very user friendly Learning Analytics dashboard that offers meaningful visualizations to the user. The problem with Learning Locker is that it does not allow users to retrieve directly the visualizations from the Learning Locker and embed them in DojoIBL. The second example described an integration with the Lemo Tool. In this case, this Learning Analytics dashboard provides more alternatives to visualize learners' performance and visualizations can be directly integrated into the DojoIBL enabling filtering and sorting opportunities for members of the Community of Inquiry.

To sum up, DojoIBL, together with DojoAnalytics, provides a suitable support for mobile inquiry-based learning, which can be enhanced in some controlling aspects by including third party Learning Analytics dashboards. It has been demonstrated that DojoIBL can make use of different Learning Analytics dashboards that facilitate the teachers and the learners to keep track of their progress in the inquiry projects. Which helps teachers to regain some controlling aspects, which could be lost by moving the inquiry-based learning processes to a mobile availability.

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