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U-Edu : Multimodal Learning Activities Analytics Model for Learner Feedback in Ubiquitous Education System

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ABSTRACT

Feedback is an essential part of the Distance Learning System. It helps learners to become aware of The strengths and the areas for improvement as well as to identify actions to improve their performance. Furthermore, it helps tutors to focus on educational policies to improve their content. The analytical techniques available today allow us to consider new applications for the quality and effectiveness of training. In this article, we propose a model for analyzing learner traces in a cloud environment. This proposal is based on the traces generated by the interaction of the different actors with our system that is compatible with the xapi standard.

Key words: Feedback , Learning Analytics, xapi, Ubiquitous .

1. INTRODUCTION

Today, learners feedback is considered as a key element that helps to improve their performance and their ability to evolve into a learning path.
The data is collected from multiple sources of activities (activity data in digital learning environments) such as chat, forum, evaluation, videos, courses etc…
These data provide information to learners and tutors. It shows implications for improving learning abilities and ways to refine tutors instructional strategies [1].
The need to standardize these data is not only to structure it but also for the exchange and interoperability of this data.
xAPI [2] and IMS Caliper Analytics [3] are two well-known educational data specifications. They enable the exchange of data between different applications and the integration of data from multiple data sources.
The specifications provide a specific format and syntax for Describing learning events occurring in learning environments.
They use a well-defined vocabulary to express interactions in a human learning environment [4]. The Learning Analytics technique offers possibilities to combine, interpret and analyze the collected data [5]. All ensure interoperability between existing platforms. In terms of visualization, dashboards are constantly used in all systems. They are useful for the purpose of visually presenting through figures and graphs the summary of a user's interactions with the system. The majority of these scorecards are intended to help teachers to better understand all the activities of the learner. Similarly, they make it possible to locate students in difficulty. Furthermore, they can also be useful in distance education, because they allow real-time visualization of all activities that learners perform in their VLE environment. teachers can adapt their course depending on the needs.
Several dashboard tools have been developed to support the teaching and learning process. It was developed through plug-ins installed in LMS such as moodle (Analytics graphs) or through a separate application that parses the LMS log files (loop tool) (Lapa) (CourseVis)

2. RELATED WORKS

Research work and projects have been deployed with Learning Analytics tools that address several learning issues across different platforms. Sandova, et all 2018 and gray, et all 2016 [6][7] use learning analytics to understand the impact of student participation in learning systems and outcomes. They predict which attending students may fail a course or have difficulty in the academic course [8].
Body language is an essential source of data that can also be inferred through several activities: Eyes tracking remain a technology for analyzing the behavior of learners [9].
The authors use eye tracking to automatically detect Mind Wandering (MW) during learning in Open and Massive Online Courses (MOOCs)[10].

Multimedia data can be very useful for studying learner responses during learning activities [11].
Gadgets plug into the computer or the human body also play a role in generating data. giannakos and all [12] uses the R-language to analyze clickstream data, as well as eye tracking, electroencephalography (EEG), video, and wristband data during the experiment.
Wearing a Fitbit HR bracelet and recording its application on his computer during his learning and working activities throughout the day. Data from different sources has been stored using the xAPI standard[13].
Mangaroska and Giannakos [14] presents the architecture of a learning ecosystem, which integrates and uses cross-platform analysis. The proposed multi-platform architecture has been put into practice via a Java programming course.
10: an open-source analysis platform moocRP allows replication of results by providing a framework for sharing and developing analytical modules, for instructors to apply

generated analyzes, and for administrators by providing a workflow for the secure data repository management and access controls [15].

3. METHODS

Based on the litterature, it is deduced that there are two streams of learning analysis research:
Some support interoperability standards [13.14.15] and others analyze the traces in a static way (not using exchange specifications).

Table 1 : Comparison of researchs

Référence	Platform	Activity	Data security	Learner profile	Spécification
13	LMS	Questionnaire , held information	yes	_	xapi
14	learning ecosystem	Log activity, test data	_	_	xapi
15	Mooc	Log activity	_	_	xapi

Comparing these three research topic, it is as following: One observes that there is a variety of learning platform and nothing between these three deals. It also shows the notion of learner profiling and also the security of the data exchanged or introduced by the learner.
As a result, we propose an architecture of an interoperable system (U-Edu). It aims to collect the data generated through the interaction of learners (different activities of learners), and to update their profile. Moreover, it aims to visualize these data with an interactive dashboard in a secure pervasive environment.

3.1Xapi statements

Collection traces are communicated in statement xapi format.This format is represented as a set of instructions (actor, verb, activity. In our case, actor is the user of the system.(learner) verb it is action performed during the experiment. Activity: it is activity during the experience this traces is represented in JSON format

Figure 1: XAPI Statement Form

```
{
  "actor": {
    "name": "John Doe",
    "mbox": "mailto:johndoe@example.com"
  },
  "verb": {
    "id": "https://w3id.org/xapi/adb/verbs/selected",
    "display": { "en-US": "selected" }
  },
  "object": {
    "id": "http://rage.e-ucm.com/activities/Countrix/questions/Capital_of_Spain",
    "definition": {
      "type:" "http://adlnet.gov/expapi/activities/question"
    }
  },
  "result": {
    "response": "Lisbon",
    "success": false,
    "extensions": {
      "https://w3id.org/xapi/seriousgames/extensions/health": 0.34
    }
  }
}
```

Figure 2: XAPI statemet JSON

4. PROPOSED MODEL

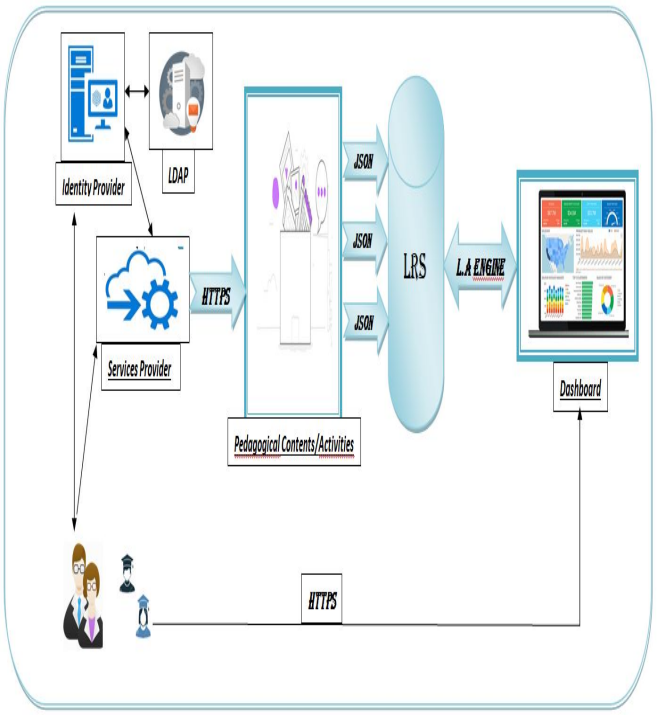

Figure 3 : U-edu architecture System

For our system (Figure 3) there are four modules:
The user, authentication module, pedagogical content module, data warehouse (LRS), dashboard
The users: it is the person concerned to use this system, there is 3 type of user
The learners: To consult the different activities proposed by the tutor, course, evaluation, certification etc…
Tutors: For putting online educational content and updates
Administrators: For maintenance, the export and the import of data.

The authentication module consists of 3 elements:
The identity provider : It is responsible for authenticating the user and retrieving additional information associated with his identity.
Service provider: It protects access to applications. It denies any access without prior authentication and redirects the unauthenticated user to its identity provider.
LDAP: It contains the users profilen. It is a directory to store information about the different actors of our system as well as different roles affected.
Pedagogical Contents / Activities: It describes the pedagogical content of our system. It is a clean environment that contains several sources of activity that learners can access. Moreover, it consists of multimedia content such as video, slides ofpower points and also courses in web format.

LRS, learning record store: It is a warehouse of data that records the traces of the learners that it generates with our system. It is a platform heberger cloud.

Dashboard: an interactive board table that analyzes the tracks recorded in the LRS and display graphs and tables in the form of a plot, it is a decision support tool.

4.1 Scenario

The user such as Learners, professors, administrators must authenticate with our platform. The system is provided by shibboleth to guarantee a higher level of security. The user must enter the connection parameters (academic e-mail address + password).
After the verification of the right of access (identity provider and ldap), the user has the right of accee to the pedagogical content provided by our platform.
The platform consists of several static content (web page) or multimedia (video), as well as activities that the learner will need. This content is prepared to be compatible with the XAPI name.
Each activity is a clean source of data.
After the interaction with the educational package, all the traces performed during the interaction are recorded as statements and sent in JSON format to our Learning record store.
Our LRS is a platform created in Cloud.
These trace generated is an interpreting analysis. Using ananlytic learning technique, it provide us with an interactive dashboard that can be helpful for the user to set by the system.

4.2 Sequence Diagram

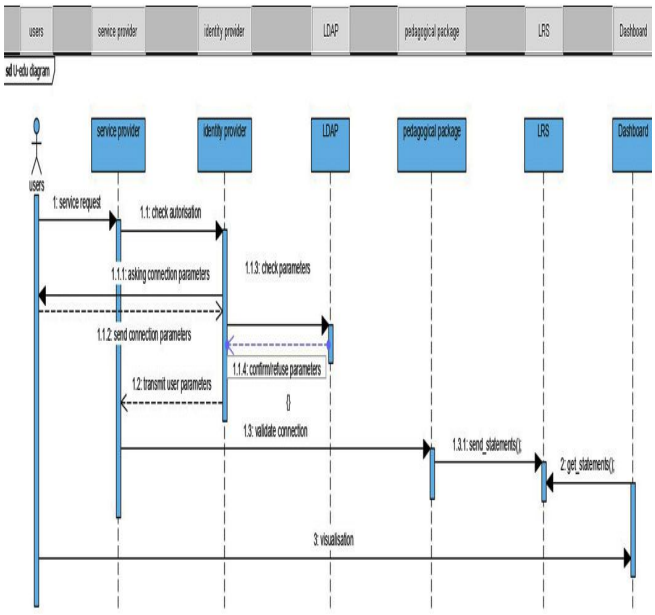

Figure 4 : U-edu sequance diagram

5. RESULT AND DISCUSSION

According to the first experiment with the system, one can deduce important results about learners. A competence-based approach is tested on our application. Thus, we have generated results for teachers and learners.
Bellow are some results:

Table 2: Result test POO assessment

#	Student Name	Student score	object	duration
0	mailto:er@umi.ac.ma	100	http://lahbi/cours/umi-example/play/pooExampleAssessment	PT37.121S
1	mailto:77@umi.ac.ma	100	http://lahbi/cours/umi-example/play/pooExampleAssessment	PT11.305S
2	mailto:fanida@umi.ac.ma	100	http://lahbi/cours/umi-example/play/pooExampleAssessment	PT10.47S
3	mailto:fanida@umi.ac.ma	100	http://lahbi/cours/umi-example/play/pooExampleAssessment	PT15.286S

Table 3 : Question answered by a learner (poo)

#	Student Name	Response	Status	Correct Response	Activity
0	mailto:er@umi.ac.ma	USGA-and-Royal-and-Ancient	true	USGA-and-Royal-and-Ancient	http://lahbi/cours/umi-example/play/pooAssessment/interactions.playing_1
1	mailto:er@umi.ac.ma	eagle	true	eagle	http://lahbi/cours/umi-example/play/pooAssessment/interactions.playing_2
2	mailto:er@umi.ac.ma	18	true	18[:]18	http://lahbi/cours/umi-example/play/pooAssessment/interactions.playing_3
3	mailto:er@umi.ac.ma	true	true	true	http://lahbi/cours/umi-example/play/pooAssessment/interactions.playing_4
4	mailto:er@umi.ac.ma	3	true	3[:]3	http://lahbi/cours/umi-example/play/pooAssessment/interactions.playing_5

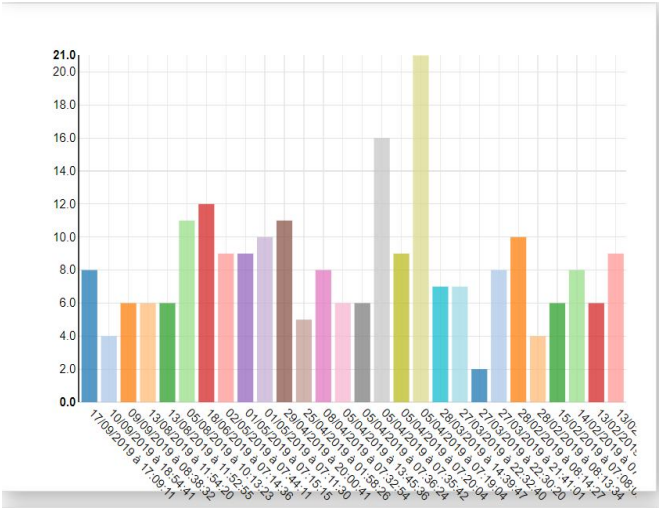

Figure 5: list of verb used

6. CONCLUSION AND PROSPECTS

In this paper , we propose a model to analyze the feedback of learners in a cloud environment. This proposal is based on the traces generated by the interaction of different actors with our system that is compatible with the xapi standards. An approach based on the securing learner data make it useful.
The next step is to update the learner profiles, a competency approach will be introduced in this direction, also to make these profiles interoperable to facilitate the reuse and exchange between the various platforms.

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