Game for Learning: An Application of Tin Can API and Learning Record Store (LRS)

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Abstract: The Tin Can API (also called experience API) is a technology specification for learning activities and data. It enables learning applications to collect data from different learning experiences, both online and offline. The Learning Record Store (LRS) is a digital storage medium that tracks learning data. It presents learning data in the form of an activity stream which can be freely and flexibly manipulated by external software. This study aims to present the different learning innovations of the Tin Can API and LRS in the form of a computer role-playing game. The Tin Can API enables the game to send learning data to the LRS. The LRS then stores and enables the data to be manipulated by other external software.

Key Words: e-Learning; Learning Management System; Learning Record Store

1. INTRODUCTION

1.1 Learning Management System (LMS)

A learning management system is a system or infrastructure that controls the delivery of training and learning content within a certain learning institution, company, or group. It provides features for assessment of learning, organization of courses, among others. (Watson, 2007) Kerschenbaum (2009) defines the LMS as having the following key features:

- Course Content Delivery
- Student Registration and Administration
- Training Event Management (i.e., scheduling, tracking)
- Curriculum and Certification Management
- Skills and Competencies Management
- Skill Gap Analysis
- Individual Development Plan (IDP)

- Assessing and resulting
- Reporting
- Training Record Management
- Courseware Authoring
- Resource Management
- Virtual Organizations
- Performance Management System Integration

The LMS is a very popular eLearning solution evident in statistics gathered by the elearningindustry website. In their study, they found that the three most popular LMSs alone already have an estimated 100million users, Moodle leading with 73.8million, Edmodo and Blackboard with 20million each. This does not include the numbers for other LMS providers yet (Pappas, 2015).

1.2 Limitations of LMS

Learning management systems carry out

management and organization of learning well. However, there are some things that they still cannot capture. Beer & Jones (2008) have identified several limitations of the LMS such as how they tend to focus on the instructor's/organization's needs more than the learner and how they limit the learners learning to what learning materials are presented in it. There is not much room for informal learning.

1.3 Overview of Tin Can API and Learning Record Store

The 70:20:10 learning theory that states 90% of learning takes place outside the classroom. This can also be applied to how LMSs constrain learning within its bounds. There is a lot of learning that takes place outside it, such as when users read articles around the web, watch youtube videos, etc. These are very essential learning experiences which cannot be tracked and monitored by the LMS. So in light of all the limitations of the Learning Management System, Rustici software has devised the Tin Can API and the Learning Record Store.

Tin Can API allows learning data to be captured not solely from the learning applications or the LMS themselves, but from a wide array of experiences both online and in the real world. Learning takes place everywhere. This is the idea that Tin Can API implements. Learners learn through interaction with other people, content, events, etc. and it can happen anywhere. When these learning experiences happen, you can record it with the Tin Can API (Project Tin Can, n.d.).

The Learning Record Store (LRS) is where all the statements are stored and accessed. If the eLearning applications are the clients of the architecture, then the LRS is the server counterpart (xAPI Architecture Overview, 2015). The LRS stores statements the same way Facebook stores events in the ticker. External applications may then access the LRS and its statements to manipulate these data and generate reports.

2. TIN CAN API

The Tin Can API (also called experience API) is a specification for learning technology. It enables learning applications to collect data from different learning experiences, both online and offline. These learning data follow a consistent format and are called "statements." (Project Tin Can, n.d.)

2.1 Tin Can API Statements

"*I* did *this*." This is generally the structure of a statement. A statement represents a learning experience. It is the core of Tin Can API. With this single line of data, the entirety of the learning experience can be tracked. Statements follow an Actor-Verb-Object format (Statements 101 - Tin Can API, 2012-2015). Here is an example of a Tin Can Statement:

"Terrence read 1Q84 by Haruki Murakami"

In the sample statement above, Terrence is the actor, read is the verb, and 1Q84 by Haruki Murakami is the object. In that single statement, a learning experience has already been defined.

2.2 Using Tin Can API and the Learning Record Store (LRS)

The Tin Can API is designed to be implemented by different learning applications. These applications may be classified into Activity Providers and Device Applications. Activity providers are authored applications that send Tin Can API statements at certain points during run time of the activity or application. Examples of these are games, simulations, and other standard eLearning applications like courseware and quizzes.

On the other hand, there are also applications that send Tin Can API statements to represent real life learning experiences. Examples of these are Mobile Tin Can applications which enable the learner to send statements when a learning

experience happens; Browser Bookmarklets which are embedded to the Internet Browser that the learner can use to send statements when he experiences an online learning experience (such as watching a YouTube video or reading an article in Wikipedia, etc.); and there are also Tin Can API implementations in Business Systems which enables tracking of an employee's job performance. All of these learning data are sent to a storage system called the Learning Record Store which stores and displays all these learning data and frees it for access by other applications (Project Tin Can, n.d.).

3. LEARNING RECORD STORE (LRS): SCORM CLOUD'S LRS

The Learning Record Store (LRS) is a storage system that stores Tin Can API statements. The LRS stores statements based on an activity stream, the same way Facebook stores events in the ticker. External applications may then access the LRS and its statements to manipulate these data and generate reports. (xAPI Architecture Overview, 2015). Below is an example LRS activity stream.
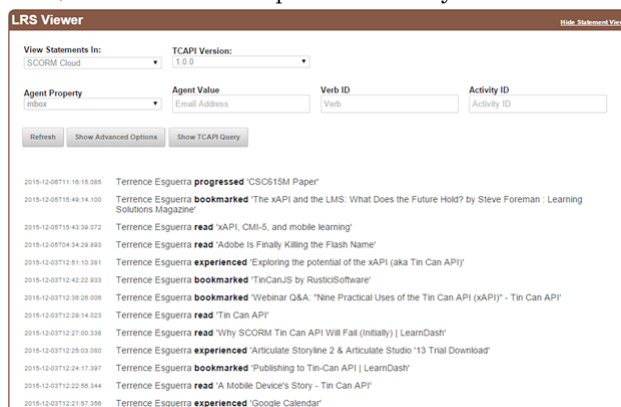

Fig 1. The LRS Viewer of SCORM Cloud's free LRS

The LRS takes learning beyond the constraints of the LMS as not only does it allow recording of different learning experiences, but it also frees the data it stores and does not limit them within its bounds. This enables interoperability with different learning applications. Itcan communicate with different Activity Providers, with other LRSs, with an LMS, and with analytics software which can evaluate and create reports of the learning data it stores (Project Tin Can, n.d.).

4. ROLE PLAYING GAME FOR LEARNING: APPLYING TIN CAN API AND LRS

Tin Can API stores data based on Activity Streams. This now allows for more accurate performance reviews. Consider the sample statements below.

**Terrence Esguerra attended CSS seminar
Terrence Esguerra attempted Example University CSS assessment
Terrence Esguerra completed Example University CSS assessment - Result: 50% Mark: Fail
Terrence Esguerra read W3Schools: CSS guide
Terrence Esguerra launched terrencesguerra.com
Terrence Esguerra received Site of The Day award – Context: Awwwards.com**

With these statements, it could be inferred that there might be something wrong with the CSS seminar, the assessment, or Terrence Esguerra's session with the assessment. This may now be validated by looking at other LRS statements from others who took the exam, took the seminar, or even all the statements tagged Site of The Day by Awwwards.com could be searched. All learning experiences are recorded in Tin Can API, it now leaves a lot of possibilities for the industries to make good use of it.

For this research, the Tin Can API was implemented through one LRS and a role playing game developed by the researcher that sends statements to the LRS.

The SCORM Cloud learning record store was used for this research. It is a free LRS hosted by the SCORM Cloud website which can be accessed at https://cloud.scorm.com/.

SCORM cloud requires users to create an account before the LRS can be accessed. Once an

account is created, it provides a very simple LRS with several realms and endpoints.
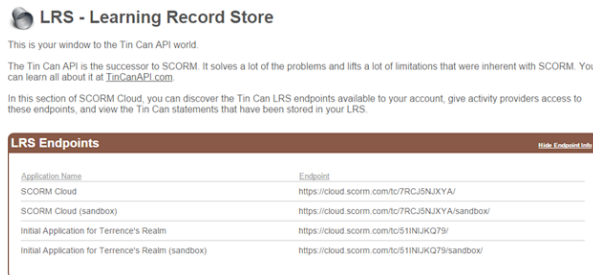

Fig 2. The SCORM Cloud LRS

The endpoints are what will be used by the applications to send data to the LRS, alongside the username and password provided by the user upon creation of the account.

4.1 The In-App Implementation

A Role-Playing game that implements the Tin Can API was created using RPG Maker MV. It sends Tin Can statements to the LRS at certain points of the game.

RPG Maker MV is a game creation software that allows use of JavaScript. The implementation of Tin Can API statements is written in JSON and may easily be manipulated in JavaScript. The Tin Can API website provides a TinCanJS API that allows for easy integration to JavaScript applications. This API was downloaded and integrated in the game. RPG Maker MV supports external JavaScript files and adds them as plugins.

4.2 Results: Learning Evidences Through The Game

The game sends learning data to the LRS in the form of Tin Can API statements. These statements are displayed in a stream chronologically. This means that the learning and development of the users will be evident just by looking at how the learning data is presented. Below is a table showing a snippet of the game that fires different Tin Can API statements. Figures 3 and 4 shows different scenarios where Learning Activities are triggered and use the Tin Can specification.

Fig 3. Game load. Load Statement is sent to LRS

Fig 4. Learner Interacts with an Object (Horse).

Every learning experience that the user encounters in game is tracked by the LRS. Tracking these learning data now enables trends to be noticed. To be more specific, a user's learning development as he progresses through the game will be evident. Whether he has learned or not will also be evident, and the reasons behind his performance would be noticed as well. This now leads to possibilities to improve not only the learner himself, but also the learning medium that is used, in this case, the game.

5. CONCLUSIONS

This paper provided an overview of the possibilities and innovations Tin Can API and the LRS can bring to the eLearning industry. It also provided a concrete application by applying these technologies to a computer learning application in the form of a computer role-playing game. Through the game, it was made evident that Tin Can API and LRS can track every learning experience that the

user encounters in the game. These learning data are stored and presented in the LRS which may then be accessed and manipulated by other users or other software. With this, trends may be spotted and reports may be generated. These may then be used to evaluate the overall learning development of the learner and the effectiveness of the learning medium used to facilitate learning.

Tin Can API and LRS are fairly new technologies. This paper only touched on its application within a certain programmed software. There are also countless possibilities for tracking learning experiences that happen outside of a formal educational setting. Two areas that interested researchers may look into are the Browser Bookmarklet and the Mobile Application software. The Browser Bookmarklet is a technology that allows users to send a Tin Can API statement regarding a certain learning experience encountered while surfing the internet. On the other hand, Mobile Applications that implement Tin Can allow users to send Tin Can API statements to represent learning experiences encountered on-the-go.

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