Prospects of implementing xAPI as a solution for progress tracking in a Blended Learning environment

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I. INTRODUCTION

The most recent “State of Learning and Development” report, published by “InSync Training” in collaboration with “mimeo” in June 2017 [2], consists of Learning & Development (L&D) industry research received through survey responses of 449 L&D professionals from 12 countries, including the G-8 (i.e. Canada, France, Germany, Italy, Japan, Russia, United Kingdom, United States of America).

The report discusses the different challenges the L&D world is currently facing, methods and technologies that can be implemented as solutions, as well as views towards what the future holds.

The statistics presented in the 2016 report [1] mentioned that 86% of L&D professionals implement blended learning, in comparison to 2017 with a 100% rate [2]. This indicates a rise towards the implementation of blended learning, even in its simplest form (e.g. video learning with face-to-face training).
This shift towards blended learning isn’t because it’s the next cool thing to do, rather because it’s the next right thing to do. There’s a good reason behind it, blended learning is a learner-centered approach for education. Approaching learning from a learner-centered point of view is considered one of the best practices for improving the quality of education [4].

This article will be divided into 3 sections: in section 1 we will present blended learning, its benefits and challenges, section 2 will cover the Experience API (xAPI), a new open source specification for learning technology, then we’ll discuss the prospects of implementing xAPI as a solution to improve blended learning in section 3.

**II. BLENDED LEARNING**

“InSync Training”, pioneers of the blended learning strategy, defines [1] blended learning as:

“A learning program in which performance objectives are matched to the most appropriate medium to ensure that participants learn -- at least in part -- through facilitator-led delivery of content with some element of participant control over where, when, pace or path in the overall program sequence.”

In other words, it’s an approach that focuses on the learners. It defines their learning needs, matches different parts of the educational content to the delivery method that’s most appropriate for each part, and then sequences the resulting learning activities into a complete program of instruction.

This approach brings the best in human interaction and technology, and then merges them into a harmonious blend. (Fig. 1)

A blended program has to contain at least 2 elements. It can be as simple as combining an element from the human part (e.g. Instructor-led classroom) with another element from the technology part (e.g. Web learning modules).

**A. Benefits**

The blended learning approach allows taking advantage of the benefits and suitability of different delivery modes for different learning outcomes and audiences. This has proven effective in multiple fields (e.g. foreign language teaching [6], pharmacy [7], military [8], teacher training [9]…).

This mix of multiple learning styles and environments gives the ability to provide better support, collaboration, flexibility and mobility [8]. The flexibility of the course allows the instructors to answer to different learners’ needs individually, which in turn leads to better learning motivation [10]. When students see their questions getting answered, they get motivated to ask for more questions.

<table>
<thead>
<tr>
<th>Education type</th>
<th>Media</th>
</tr>
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| Live face-to-face (formal) | - Instructor-led classroom  
                        | - Workshops  
                        | - Coaching & Mentoring  
                        | - On-the-job training |
| Live face-to-face (informal) | - Collegial connections  
                        | - Work teams  
                        | - Role modeling |
| Virtual collaboration (synchronous) | - Live e-learning classes  
                        | - E-mentoring |
| Virtual collaboration (asynchronous) | - E-mails  
                        | - Online bulletin boards  
                        | - Listservs  
                        | - Online communities |
| Self-paced training     | - Web learning modules  
                        | - Online resource links  
                        | - Simulations  
                        | - Scenarios  
                        | - Video & Audio CDs / DVDs  
                        | - Online self-assessment  
                        | - Workbooks |
| Performance support     | - Help systems  
                        | - Print job aids  
                        | - Knowledge databases  
                        | - Documentation  
                        | - Performance / Decision  
                        | - Support tools |

**TABLE I. MEDIA USED IN BLENDED LEARNING [5]**

![Fig. 1. Combining human interaction with technology](image-url)
Another benefit is that students become active independent learners [5,10]; they have control over when and where they study, therefore directly participating in the learning process without the need for their teacher to be always present.

Speaking of teachers, the blended learning approach shifts their roles from lecturers to facilitators [10], which reduces their workloads since students are required to prepare for their classes beforehand.

**B. Challenges**

As good as the benefits above might seem, nothing comes without drawbacks, and of course blended learning isn’t an exception.

Even though the blended approach is very promising, businesses and organizations are still hesitant to implement it [2] for multiple reasons:

- The complexity of instructional design;
- The length of the periods of implementation;
- The high costs involved.

Each of these reasons are interrelated, the length of the periods of implementation is due to the complexity of instructional design. Each learning need requires educational content; each part of the content requires a corresponding delivery method; and of course, the resulting parts need to be sequenced and blended together. All of this requires a team of experts to be assembled to take care of the design and implementation of each part of the blend, hence the high costs.

Because of the high costs involved in the design of any high quality educational program, most L&D professionals tend to play multiple roles (3 on average in 2016 [1]), most of which aren’t directly related to their field of expertise. Because of that, most of the online courses parts of the supposedly “blended” programs aren’t well designed, they tend to present the same material, and are led by the same instructors as the traditional classroom courses [10].

Another challenge involves progress tracking, with the increased flexibility in terms of learning time and space, an enlarged psychological and communication space (i.e. transactional distance) emerges [11]. As the transactional distance increases, the instructors’ judgment over what learners actually learned becomes clouded. This makes it difficult to keep learning experiences, often a combination of online and offline activities, within a single blend. Failing to do so, means that those learning experiences become disjointed. This can lead to duplication of content, wasting time and resources as a result.

**III. THE EXPERIENCE API**

**A. Background and History**

A LMS (Learning Management System) is a piece of software that we use nowadays to manage and quantify people’s knowledge of a particular subject. These LMS are used by different people with different backgrounds, some are used in schools, others in businesses, and they all come with a variety of features that mainly depend on the environment they’re used in. This variety imposes a need for an interoperability standard [12]. It’s a technical standard that tells programmers of a particular LMS how to write their code so that companies / schools would find it easy to switch between LMS.

The “Experience API” (xAPI) is a new open-source specification for learning technology. It was created by “Rustici Software” back in 2013 [3] after around 3 years of research with the purpose of defining a new standard for creating and publishing courses in a LMS (Learning Management System), as well as tracking learning activities in a more effective way.

“ADL Standards” (Advanced Distributed Learning) published xAPI to be the successor of another standard called SCORM (Sharable Content Object Reference Model). SCORM is an interoperability standard in the e-learning world. The need for an interoperability standard is explained in the SCORM’s official website using a good relatable analogy [13]:

“Let’s take DVDs for example. When you buy a movie on DVD you don’t need to check if it works with your brand of DVD player because DVDs are produced using a set of standards. Without these standards, in order for a studio to release a new movie on DVD, they would need to make differently formatted DVDs for each brand of DVD player. This is how online learning used to be before SCORM was created.”

SCORM was published in the year 2000 by “ADL standards” which is a research group sponsored by the United States Department of Defense. Up until late 2000s [14], SCORM had
been doing a great job. However, with the emergence of web 2.0 and smartphones, the way people learn went through a big change. People were learning more outside the LMS than within it. This made these systems only have visibility into a tiny fraction of a person’s knowledge and learning experiences because SCORM didn’t allow the tracking of anything that happens outside the LMS (e.g. reading an article on a web 2.0 website, learning something through a mobile app…).

In 2010, ADL issued a call for research in order to improve things in SCORM. The project was awarded to “Rustici Software” who then started gathering information about what the next generation of SCORM should be like [14]. 3 years later, ADL published the result of that research under the new official name “Experience API” (xAPI in short) instead of the name Rustici Software used during the research “Tin Can API”.

B. Technical Specification

The xAPI consists of 4 sub-APIs [15]:

- Statement (explained below);
- State: allows recording of the state of an activity, this allows resuming activities across sessions and devices;
- Agent: individuals, personas, or systems;
- Activity profile: describes and identifies learning activities.

These sub-APIs are handled via RESTful (Representational State Transfer) HTTP methods.

At the heart of xAPI, there is the LRS (Learning Record Store). The LRS is a repository that’s used to store learning experiences as a list of statements [16]. Those statements are based on a technology called “Activity Streams” [17] which is used by Social Media websites; they are in the form “Noun, verb, Object” or “I did this” (e.g. Mohamed read an article about Quantum Computers). The LRS can be standalone, part of a LMS, or part of other learning systems (e.g. simulation); it can be accessed by other LRS, reporting tools, or LMS (Fig. 2).

In one of his webinars, Mike Rustici, president of “Rustici Software”, explained [18] the details of the functionality of xAPI using what he likes to call “Layers of the onion analogy”.

1) L1: xAPI as a modern SCORM

xAPI is the next generation of SCORM [13]. In other words, it’s an interoperability standard that allows e-learning to use modern technologies.

xAPI is based on a set of RESTful web services that carry a JSON payload that allows learning activity providers (e.g. LMS, a simulator, a medical device, a mobile app…) to send the statements to the LRS.

2) L2: xAPI and progress tracking

People nowadays tend to learn more informally [19]. They learn anything anywhere (e.g. reading a scientific paper, engaging in a conversation with a colleague…). This is why one of the main benefits of xAPI is tracking any learning experience [20], wherever and however it happens (Fig. 3).

xAPI also offers the ability to develop tools like the “I Learned This” bookmarklet which can be configured, linked to a personal LRS, and then used to record self-directed learning experiences (e.g.
watching a TED talk). The bookmarklet is a simple tool used in the web browser. Developers can create more advanced systems that would be used to track offline learning experiences (e.g. a student participation module that’s integrated within the school’s grading system, a smart bracelet that tracks sports performance…).

3) L3: xAPI and data accessibility

xAPI requires that the LRS makes all the data related to learning experiences accessible and transferable across systems (Fig. 4) so that it can be analyzed using any tool.

Let’s take the example of an employee who moved from a company to another, all of his/her data can be transferred from LRS A to LRS B via a PDL (Personal Data Locker) in the form of a personal LRS. This PDL can be regarded as a living resume which contains the employee’s entire learning experiences (Fig. 5).

4) L4: xAPI and correlating job performance with training

Thanks to data accessibility, comparing training data to actual job performance data is possible. The comparison allows instructors to identify the training paths that lead to the most successful outcomes or those that lead to problematic outcomes (Fig. 6). Ultimately allowing businesses and organizations to determine the effectiveness of their training programs and measure ROI as well.

IV. XAPI AND BLENDED LEARNING

As mentioned above, one of the challenges that blended learning is currently facing is related to the fact that instructors often don’t have a clear idea about what the learners actually learn. This is clearly a progress tracking problem.

A blended program usually contains a mix of online and offline learning activities, so the solution to that challenge is an implementation of xAPI with the purpose of refining the program’s different parts (Fig. 7).

Fig. 4. Example of data transfer across systems

![Fig. 4. Example of data transfer across systems](image)

Fig. 5. Example of PDL use

![Fig. 5. Example of PDL use](image)

![Fig. 6. Correlation of job performance with training](image)

Fig. 6. Correlation of job performance with training

![Fig. 7. Example of implementing xAPI within a blended program](image)

Fig. 7. Example of implementing xAPI within a blended program

First, the organization implements the xAPI and links all of the different parts of the program to a single LRS. By doing this they can collect data about all of the learning activities of the program.

The second step comes after analyzing the collected data at the end of the program. Instructors will have a clear idea about what the learners learned and on which part of the blended program they learned it, therefore allowing them to filter the duplicate content.

Finally, the organization creates a new filtered blended program and tests it on a new group of
learners while repeating the same process. With each cycle, the quality of the program improves.

**V. FUTURE WORK**

Our future work involves implementing the xAPI in one of the popular LMS (Learning Management System). We’ll then conduct an experiment with the purpose of collecting data related to the learning experiences of undergraduate students.

At the end of the experiment we’ll analyze and classify the collected data using R [21] in order to determine the effectiveness of xAPI as a solution to improve e-learning in Morocco.

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