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Towards the Organization of a Portfolio to Support Informal Learning*

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The accelerating change that the society is experiencing worldwide is exposing the weaknesses in the education system we have inherited from previous generations. Every year lots of kinds of jobs disappear and new job descriptions are being created as well. Lifelong learning is no longer a theoretical concept, but a very real need for most people. Not all learning comes from formal education processes. Students and professionals are getting actionable knowledge from all kinds of sources and activities.

Thus, informal learning, alongside competence-based learning and learning outcomes is getting a lot of attention lately from human resources departments, academics and policy makers. A number of countries and organizations are busy defining guidelines for validating and evaluating informal learning experiences and formalizing its outcomes. In a globalized society where technology has brought together different cultures and educational systems, managing to keep track of a learner's competences is a daunting task, and especially when trying to take into account the competences acquired through informal means.

In this paper, we propose a framework to gather, enhance, organize, evaluate and showcase a user's informal learning using a social approach to engage the learners to use the system by providing valuable recommendations, contacts and feedback.

Keywords: informal learning; non-formal learning; e-learning; eLearning; lifelong learning; social learning; validation; evaluation.

1. Introduction

Alvin Toffler, in his book "The Future Shock" [1] talks about the accelerating pace that future holds, raising a warning about the stress and disorientation that so many changes taking place in a short period of time are introducing. The pace of changes induced by technology is increasing in all areas of society. Toffler's point is that the tactics of the past will not be successful in the future. If future shock is to be avoided, society must control the accelerating pace of change and must make plans for the future and the changes it will bring. This need for different tactics is affecting specially education and training.

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The Delors Report emphasizes the importance of learning to learn as a way to cope with and adapt to new situations and challenges that appear in a world where everything changes quickly. Lifelong learning prioritizes learning new skills and attitudes rather than perishable or encyclopedial knowledge [2].

The origins of lifelong learning started in the 1960s and 1970s with discussions about alternative education methods. Lifelong learning aims at a revision of education in modern societies, because of the central role of education. Lifelong learning is an attempt to change the learning process, from enclosed environments such as learning institutions to a totality of learning events, even those that occur during everyday life [3]. In lifelong learning individuals are not passive receivers of information but active and self-organized learners.

The Lifelong Learning Programme of the European Community [4], is centered on promoting and facilitating continuous learning for all kinds of social, ethnic and economic groups. Inherent to lifelong learning are the concepts of formal, informal and non-formal learning. Formal learning refers to the education received from a recognized education center that leads to a certification, with everything else being either non-formal or informal learning [10].

Non-formal learning is learning that takes place alongside formal learning but does not necessarily lead to a diploma or any kind of formal acknowledgement. It is structured in nature and is provided by trained individuals as a complement to formal education [11]. Examples of non-formal learning are complementary classes for school, sports training, art classes, music, etc.

Informal learning (IL) refers to all learning resulting from activities individuals undertake in their own time. It essentially starts at birth and accom-

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panies the individuals throughout their life as a natural by-product of their activity. IL can be intentional or not and is unstructured in terms of objectives, time investment and support [12]. Examples of informal learning are learning to ride a bike as a kid, learning to cook as a student or learning a programming language by searching for information online.

An important thing to note at this point is that the lines between formal, non-formal and informal education are becoming blurred in the sense that we end up participating in more than one of these types of learning at the same time. For this reason, it is important to take into account the effort put into learning outside the formal structures and evaluate individuals accordingly. It would be an error to continue evaluating individuals solely based on their formally attained degrees when we are exposed daily to so much information that we are essentially constantly taking part in informal learning activities.

The concept of informal learning and its potential in the development of competences has been present for many decades. In 1999, the European Commission signed he Bologna treaty recognizing IL as a basic element of lifelong learning [1]. In a number of documents published since then, the European Commission emphasizes the importance of recognizing IL and identifies the need for a framework for the Accreditation of Prior and Experiential Learning (APEL) [4, 5].

This has given birth to a number of European initiatives for the validation of informal and non-formal learning. The leading European organization working towards these goals is the European Centre for the Development of Vocational Training—CEDEFOP (www.cedefop.europa.eu). Its mission is to gather IL experiences from European countries and define a European qualifications framework. As a result, the European Qualifications Framework (EQF) for lifelong learning was presented and adopted by the European Council and the European Parliament in 2008 [6]. The goal of the EQF is to facilitate the communication of qualifications among European countries.

In 2009, CEDEFOP published a set of guidelines for the validation of non-formal and informal learning; a framework of guidelines to be applied voluntarily [7]. The framework pushes for validation in four different, but equally important levels: European, national, organizational and personal.

Presently, as laid out by the roadmap of Europe 2020, the Commission is centering on the labour market and the creation of smart sustainable market opportunities. To this end there is a big interest in the evaluation and validation of the non-formal and informal learning of the European workforce.

All the above provide evidence that IL is a recognized and important part of the education process. Even more so in technological disciplines where the rapid changes mean that what is new today will be old tomorrow [8]. Furthermore, megatrends rising form the internationalization and globalization of modern society require continuous learning in order to keep up with [9]. For this reason, we consider that it is important to educate learners on the importance of continuous informal learning and provide them with the appropriate tools for it.

In this paper, we present the design of a framework we are developing for offering support for a learner's IL. The framework is geared towards registering informal learning activities (ILAs) enriching them with metadata like tags and evidences and then present them in the form of an IL portfolio with social hooks where learners will be able to examine the IL profile of their peers, evaluate their activities and receive recommendations based on their own activity.

This paper is organized as follows. Section two presents the state of the art in the fields of non-formal and informal learning. Section three introduces a new approach to validate informal learning by using a social approach based on peer collaboration and recommendation in order to build a knowledge base, to evaluate the learner's activity and provide recommendations based on the activity of their peers. Section four describes the system architecture of a portfolio to gather informal learning activities and to support the social approach described in section three. Section five describes the interactions between the learner and the portfolio as well as the interactions that happen among the system internal components. Section six explains the methodology used in the development of this project and section seven summarizes our main conclusions.

2. State of art

For the remainder of this document we will use the term informal learning (IL) to refer to both informal and non-formal learning since the framework we are designing will not make any distinction between the two.

A very important aspect of the IL process is social interaction. Learning by observing others, by working with others, tutoring and many more aspects of social learning play a very significant role in IL. Miller and Dollard had proposed a theory that imitation is an instrumental learned behavior and that by imitating others, an individual eventually succeeds in their goal and learns from the process [16]. Afterwards, Bandura [14, 15] was one of the

first to study social learning and remark on how people tend to learn by observing others.

In more recent years, the advances of IT technologies and especially Web 2.0 and mobile technologies have given a boost to IL by providing the means to liberate the learning process from any location and time constraints [17–23]. The inherently unstructured nature of IL makes it that the benefits of connectivity, mobility and the social tools available today make it more approachable than ever. Social networks and tools like blogs, wikis, messenger software, YouTube, Facebook, Twitter, Instagram and Flikr exist and operate by merit of Web 2.0 technologies and all offer huge IL opportunities.

There are also a number of tools that provide direct assistance to IL and lifelong learning in general. TENCompetence is a European open source project that provides an infrastructure that fosters lifelong learning [24, 25]. Similarly, the TRAILER project provides tools to the learners to gather their IL activities, assign them to competences, build an IL portfolio and showcase their competences within an institution or an organization [27–29]. Other IL portfolio tools are detailed by Perennes and Duhaut [30], and McHenry and Stronen [31].

Additionally, we find in the literature many proposals for platforms that support collaborative and social learning. The L project proposed a platform with a centralized center for the learning material and clients for each learning institution that wants to connect to it [31]. MCPresenter is a mobile learning tool that supports collaborative learning activities in the classroom [32], Mobltz promotes the co-creation of learning contents through the use of mobile devices [33], L4All creates learning timelines for its users and allows them to see the timelines of other users for comparison and motivational purposes [34] and finally the Network Awareness Tool builds a learner's network of contacts based on their learning activities [35].

In the subject of actual validation and evaluation of IL, the majority of the literature proposes the existence of an evaluator in the form of a physical person or a committee who reviews the evidence provided [36–39].

More specifically in engineering contexts, a number of studies promote the co-existence of formal and informal education by providing techniques to seamlessly move from one type of learning to the other and correctly evaluate the learners without entering into jurisdictional problems. Kotys-Schwartz et al. [40], propose a six-strand approach for characterizing the informal part of a student's learning. These strands evaluate certain aspects (interest in science, scientific understanding, reflection, etc.) of a learner's evolution thanks to IL activities. Grant et al. [39], propose the use of Learner Agent Objects (LAO) for improving informal learning activities like collaboration and sharing of best practices. LAO is a framework for creating and transferring knowledge.

Having established in this section the importance and the existing interest in IL, we will proceed to describe our proposal for building a framework that will help learners gather their IL activities, build their IL portfolio and have access to a set of tools that will help them further explore and evolve their IL.

3. A social approach

In the context of lifelong learning, it is important that learning and skills acquired outside formal education and training do not remain invisible or poorly valued. So, the validation of informal learning is an issue to be solved. The purpose of this validation is to make visible the knowledge and experience held by a person with independence from how he learned it [43].

However, due to the nature of IL, its validation is a complicated issue. The natural tendency is to translate competences acquired through non-formal and informal means to formal ones and try to apply the same validation rules and methods. These methods however tend to be strictly defined and structured and are in many cases unsuitable for evaluating the mostly unstructured activities of informal learning. This relies to the traditional challenge of structuring and formalizing entities that are unstructured and heterogeneous by nature, in order to analyze or process them by means of quantitative or qualitative techniques.

The experience we gathered during the execution of the TRAILER [63] project has led us to consider alternative approaches to the issue of validating non-formal and informal learning. TRAILER had a heavy focus in the matching of ILAs with predefined learning goals and standard competences. What we propose is to provide a social framework that will center on peer collaboration and recommendation. So, the system will be able to provide recommendations based on the activity of their peers. While TRAILER was focused on the categorization of the ILA's being fed into the system, our approach is to provide the user with valuable information: recommendations and social interactions. By focusing in providing a valuable output for the user, we pretend to increase the rate of engagement, and thus build a knowledge base from where we can extract later an evaluation of the learner's activity and their progression towards attaining certain competences.

The idea is to provide learners with the sensation

that they get something valuable out of the system: recommendations, contacts, engagements, and social interaction. TRAILER and other projects where focused too much on a sound knowledge base. In our opinion to catalog and organize data, you need data! Instead of getting the underlying model of learning outcomes and competences perfect, our approach is to try to get some active users to interact with a system in "beta state" that we can improve by iterating.

So, the users will have their private space where they can store all the ILAs they undertake and attach them to a certain competence if it is relevant. If they wish, they can make their activities public to everyone or to a certain group of people (e.g., the people they are related to professionally). These public activities will be ratable, commented upon, followed or adopted by the other members of the community. The traffic and the ratings generated for each activity is a good starting point for its evaluation.

Apart from the active user participation, the platform will implement a recommendation system that will recommend to a learner, activities undertaken by learners with similar informal learning portfolios. So, the learner will receive a message with a list of popular activities inserted in the system by other people related to competences or activities from the learner's portfolio. These activities can be both positively rated for the learner to look into, or negatively rated, in order to be avoided. This feature should help further promote informal learning by exposing potentially unknown sources and activities to the learners.

We propose an informal learning portfolio (shown in Fig. 1) that will receive as ILAs either manually from learners or in more automated ways directly from webs, applications and online tools. The portfolio will have support for different roles of users like learners and supervisors. The supervisors could potentially be teachers, professors or company supervisors that may need to have access to some views of the portfolios of the learners affiliated to their company or institution.

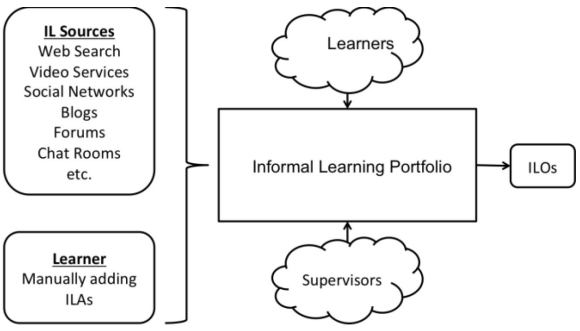

Fig. 1. High-level concept of the Informal Learning Support Platform.

Finally, the portfolio offers support for exporting ILAs in Experience API (xAPI, formerly Tin Can API) format using web services to any external interested parties. Since xAPI provides only syntax, we need to address the challenge of providing a new vocabulary suitable for the tracking of IL. However, the learner will not be exposed to this internal representation, but will provide information and get value from the knowledge base through the user interface.

4. Portfolio design

The Informal Learning Portfolio is composed of five basic components shown in Fig. 2. The communication of activities to the platform will be done using the Experience API. Once in the platform, the activity is stored in a Learning Records Store (LRS). Subsequently, once stored into the system, the ILA can be enriched with metadata like evidences, tags, evaluation metrics and related competences.

For clarity, we refer to these enriched ILAs as informal learning objects (ILOs). In the following paragraphs, we will go into more detail for each of these characteristics.

4.1 Learning records store

The LRS is the database where the learning activities are stored as ILAs (Informal Learning Activities). The term LRS was used to define the place to store learning records by the Tin Can API (tincanapi.com/learning-records-store). Tin Can API is now known as the Experience API (xAPI) and is the API we are using to communicate learning activities to our LRS. The xAPI is a specification that describes the interface and the storage and retrieval rules for statements of experience (http://www.adlnet.gov/capabilities/tla/experience-api.html). The format for communicating activities is a tern: <Actor, Verb, Object>. One example of ILA may be <*'Peter', 'Read', 'Trailer Project Overview'*>.

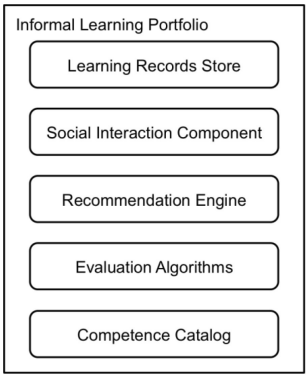

Fig. 2. Overview of the framework components.

Such description will be enriched with additional information related to the activity itself, with information from similar or related activities into the LRS, with tags provided by users or the Social component of the portfolio, with some rates provided by the evaluation component, with explicit references to other activities the recommendation component identifies for the actor, with reference to the Competences this activity may contribute fulfill, and, in fact, with different kind of information portfolio components may infer from the rest of the LRS contents and the ILA, by considering the reasoning, inference, recommendation and evaluation mechanisms supported by the IL Portfolio.

Regarding the LRS, we are currently building our prototype on the Advanced Distributed Learning (ADL) LRS (adlnet.gov/tla/lrs.html). It is an open-source LRS available from github that uses PostgreSQL for its database and supports OAuth/OAuth2 authentication for the xAPI communications.

4.2 Social interaction component

The last decade has been largely characterized by the expansion of social networks. The amount of content and social interaction in these networks has turned them to one of the primary sources of IL [46]. This, in turn, has driven the entire process of IL to adopt a more social character [47, 48]. For example, the extent of Facebook's influence in education, coupled with the fact that it has been observed that students are more likely to express themselves on a social network than in a Learning Management System (LMS) [49], has led many education institutions to establish a presence there in order to be in touch with their students [50].

Collaborative or social constructivism has also gathered a lot of momentum with the introduction of technology-assisted education processes. Learners are no more just consumers of educational material, but they are also producers. This is especially evident in the case of IL where learners can create learning elements, expand on existing ones, discuss and interact among themselves [51].

Learners will have their private space where they can store all the ILAs they undertake and attach them to a certain competence if it is relevant. If they wish, they can make their activities public to everyone or to a certain group of people (e.g., the people they are related to professionally). These public activities will be ratable, commented upon, followed or adopted by the other members of the community. Contribution of the rest of the community to an ILA is an enrichment process that allows us to extend Informal Learning Activities to Informal Learning Objects. In this way, social contributions extend the information of ILAs with comments, ratings or tags, so this new information that may be used for the rest of components to evaluate, recommend or relate Informal Activities of the same or different actors.

4.3 Recommendation engine

The recommendation engine will provide learners with personalized recommendations for further ILAs based on their profile and their recent activity.

The simplest iteration of a recommendation engine can be based on collaborative tagging. Tags can help learners discover new material that they would otherwise miss [52]. Macgregor and McCulloch [53] explain how a collaborative tagging mechanism can be more effective in learning material discovery than controlled vocabulary tagging.

Moving onto more complex recommender systems, metrics like accuracy, coverage and performance can be combined with measures taken from educational research like learner interest, learning history and behavior to provide accurate recommendations for further IL [54, 55]. There is a lot of information in the literature about education-oriented recommendation systems [56–58].

The platform we are proposing will have access to a number of metrics that we are confident will provide us with a dataset capable of generating accurate recommendations. These metrics include:

- Learning interests of the user or other users. Such interests may correspond to competences of the catalog or to tags frequently used by the social component of the portfolio.
- Informal Learning history of the user, considering all past ILAs, average evaluation, etc.
- Average time investment in similar Informal Activities.
- Social interactions in which the user has participated or it has been involved.
- General tendencies of learners that may recommend the user to initiate new learning strategies, or new topics of study, or to readdress their learning interests.

4.4 Evaluation algorithms

The evaluation of the activities within the platform will be carried out by a combination of self-assessment, peer assessment and activity popularity/adoption rate. All these activity streams will combine to provide a single evaluation metric for the different ILOs. In turn, these metrics will feed into the learner's competence assessment where a competence supported by a number of highly-evaluated ILOs will be considered as more valid, or attained.

Since the platform is at an early stage of design and development, we are currently unable to go into much more detail about the implementation of these

algorithms since we expect it to change considerably as the specifics of the interactions among the different components of the platform become more defined.

4.5 Competence catalogue

One of the biggest challenges of designing the platform is the competence catalogue. International efforts to define a comprehensive competence catalogue like ISCO-08 [59, 60] proposed by the International Labour Organization (ILO) may very well cover the entire spectrum of occupations, but for practical purposes cannot be used in an online portfolio because it is too long with extremely specific definitions that make it very complicated to find the exactly appropriate competence for an activity.

Our proposal for tackling this problem is to use a very generalized and simple initial competence list and let the learners define their own competences. These newly defined competences will be added in the centralized list and help populate it. As the user types a competence, they will be presented with proposals for already existing ones in an effort to facilitate the process and reduce synonyms. This set of competences includes the particular learners interests as user specific competences and more general and accepted competences established by supervisors.

5. Portfolio interaction

The five components of the portfolio interact among themselves as it is shown in Fig.3. The ILAs enter the system using the Experience API (xAPI) and are stored into the LRS. From there, the ILAs can be evaluated, enriched with metadata and associated to competences. This helps build the semantic model of the activities and transform ILAs to ILOs. All the additional information is inserted back to the LRS where ILAs and ILOs

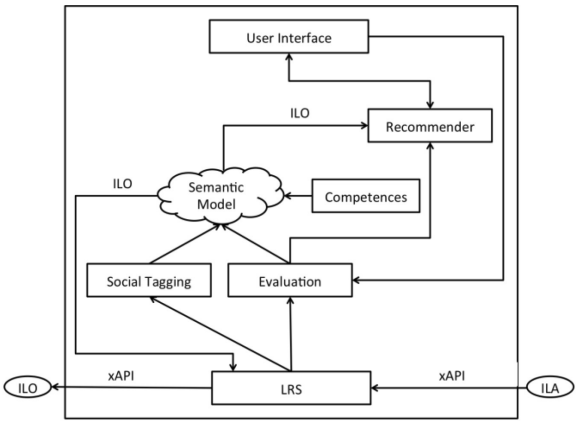

Fig. 3. Internal diagram of the Informal Learning Portfolio.

end up coexisting. The recommendation engine takes its input from the ILOs, the evaluation module and the user interface and outputs the results directly back to the user interface.

Apart from the internal functionality, the framework provides support for exporting ILAs and ILOs to external services and applications that may require them. In the case of ILOs, they will be exported using the xAPI protocol where the *object* will be the enriched version of the object that entered the platform.

5.1 User interface

From the user interface, the learners will be able to import their activities from different services/providers or manually define new ones. In a similar way, users can update and delete activities stored in their portfolio.

Any user (with proper privileges on the system) may read, enrich, tag, comment, evaluate and recommend activities of other users. Once a learner considers that an entry is "content complete", they can choose to make it visible to everybody or to a certain group they may be part of. This activity will then be visible in his or her portfolio and will also be available for the recommendation engine to use and recommend to anyone who has permissions to view it. This contribution to enrich other learner's activities may be of special interest to learning supervisors.

We plan to provide a lot of flexibility in the organization and navigation of the learner's portfolio so that the learner can: view activities in a collection, view collections relevant to an activity, view activities related to a specific competence or view competences justified by a collection of activities.

Interactions taking place within the portfolio may be divided into two main categories: user and internal (system) interactions. User interactions are either initiated directly by the user or at least involve or require some user action despite being initiated automatically or triggered by external actors. In fact, the term user refers to any learner that has an account in the system and manages their IL evidences. System interactions are those that happen among the system internal components and are usually triggered by internal conditions or on a predefined schedule. In many cases, such internal conditions may be consequence of a user interaction.

When users want to manage activities of their portfolio, two levels of privacy may be defined for such activities. Activities are private when visibility and access to view, edit, delete or modify the activity information is restricted to the activity owner. An activity becomes 'Public', when the owner of the activity allows other users to enrich information of

his/her activity. Such enrichment usually is restricted to make evaluations, comments, tagging or to relate the activity to other activities of the LRS.

One of the most important and critical aspects of the interaction with the portfolio, is how new activities are sent to the portfolio. This functionality is especially critical since it must be user-friendly, simple and as automatic as possible. A complex interaction to communicate an ILA to the portfolio may be discouraging for the user. In this sense, we propose to consider three alternative ways to send ILAs to the portfolio:

- User communicates an activity manually: User requests the system to send an informal learning activity to his or her portfolio. Filling a form with the activity detail may do this. The necessary information to register a new ILA is the following:
  - Activity name: That is used to identify the activity. It is an initial description. Such description is used to define the three elements of the xAPI format of the ILA to be stored in the LRS: <Actor, Verb, Object>. If Actor is not specified, the user logged to the portfolio is assigned as actor of the ILA. Verbs may be proposed from an internal dictionary on the portfolio. Objects may be identified by general descriptions or by resources identifiers.
  - Date undertaken: That date is used to have the time stamp when the activity takes place and to chronologically relate this activity with the rest of ILAs of the portfolio.

  There is non-mandatory additional activity information that must be communicated to the portfolio at creation time, or incorporated to the ILA later. Notice that the following information may correspond to an enrichment of the ILA done by the activity owner, by other users of the framework in a social, recommendation or evaluation process, or automatically by the recommendation, evaluation and social tagging engines of the portfolio architecture.
  - URL, OID: Objects, documents, webs, ... may be specified. It is interesting to indicate URL to refer to informal learning activities performed on the web or to identify the provider of the ILA.
  - Competences: The activity may contribute to satisfy one or several competences of the portfolio catalogue. The activity owner or other users may provide this contribution, and it may be quantified.
  - Tags, Evaluation Rates, Recommendations: Such information may be provided by other users of the informal learning portfolio or by the portfolio engines.
  - Evidences: This field allows the user to incorporate execution evidences to the activity. This information is specifically important when activities require certain acknowledgement or formal evaluation. In Informal Learning, this kind of evidences are not pre-established, usually is subjective and there is a broad variety of facts that may certify an activity execution, so it is difficult to formalize this contents.
  - Comments: Any other information of interest for the activity or for the activity owner.
- An external source pushed an activity: An external source of informal activities pushes an activity to the user portfolio. The external source makes a remote call to the xAPI of the portfolio. In this case, the activity information (tern) provided by the external source must accomplish the xAPI format. In this case, Actor of the tern corresponds to a portfolio user that has authorized this push communication. User is notified when the new activity is added to his/her portfolio. The ILA is stored temporally to the user LRS, until he or she choose one of these options:
  - Edit: the user interface presents the user with the same form used for creating an activity with all available data prefilled. In the case of tags and competences, the system may offer some recommendations if enough data are available to do so. User may modify the contents (if it is necessary) and accept or discard the new incorporation to his/her portfolio.
  - Discard: user must confirm to delete this activity of the portfolio.
  - Ignore for later: the user maintains temporally the activity in the portfolio to edit/discard later.
- An external source pulled an activity: This action is initiated by the user or by the portfolio itself. An external source of informal activities is pulled to provide activities to the portfolio. The portfolio with a xAPI call requests the external source. As in the previous case, the activity information (tern) provided by the external source must accomplish the xAPI format. Actor of the term corresponds to a portfolio user that has authorized this pulling communication. ILAs are stored temporally to the user LRS. User is notified of new activities and requested to accept or discard them. Options of the user are the same of the previous case.

5.2 Internal behavior

In the previous section, we described three different ways a user may follow to include some additional ILAs into the user portfolio. These changes in the LRS contents may produce some reactions in dif-

ferent portfolio components to infer new recommendations and show them to the user, to extend the list of tags, infer new dependencies between informal learning activities, etc. In fact, changes in a subset of informal learning activities (ILAs and ILOs) may propagate changes to the rest of ILOs of the LRS. In this section, we show some examples of such changes.

- A new ILA is added to LRS.
- When an ILA with a tag is added to the LRS database, Social Tagging component is notified to register the new tag (if it does not exist) and to update tag's occurrence counter. In case this tag already exists in the Social Tagging component, tag relationships are analyzed and the Recommendation Engine is requested to propose new tags for the inserted ILA.
- In a similar way, when the new ILA specifies competences of the Competence Catalog, this component is notified to register the new contribution. The Recommendation Engine analyses similar patterns between competences and ILAs to propose some new competences to this ILA.
- In this case, the Evaluation Engine is not activated although the user required an evaluation of the ILA.
- The user request to modify information of an existing ILA.
- The LRS database searches the ILAs that better matches the criteria provided by the user. ILAs information is provided to the user, and the Social Tagging component and Competence Catalog are requested to obtain new tags and competences to make recommend to the user (by Recommender engine).
- If the ILA's modification involves its evaluation, the Evaluation engine guides the user to better assign a global rate to the ILA, taking into account several indicators and previous evaluations of the ILA.
- An ILA is deleted from the LRS.
- To delete an ILA from the LRS, the basic information of the ILA is removed and all enrichment generated by the user, other users, or the portfolios engines must be updated. Al information related to associated tags, competences and recommendations must be updates in the corresponding engines and components. For example, occurrences counters of tags, competences etc. must be updated. If any of these counters is turned to zero, tags or competences may be eliminated from the portfolio and tag or competence relationships modified.
- Evaluation Engine eliminates ILA evaluation rate and updates user portfolio evaluation consequently.
- Portfolio Recommendation and Evaluation.
- Recommendation and Evaluation Engine may be requested to provide evaluations and recommendations to the user after changing an ILA. In this case, the evaluation and recommendation scope only refers to the Informal Learning Activity in order to properly set ILA's information.
- However, user is more interested in having a more global Recommendation and Evaluation of its portfolio, that is, all their ILAs. In this case, user may request such global evaluation or periodically, these engines are automatically activated to recalculate global recommendations and evaluation of all user portfolios. In this case, the Recommendation Engine requests information to the LRS database for user ILAs; to the Social Tagging component and the Competence Catalog for tags and competences respectively, and their relationships; and to the Evaluation Engine to for ratings of user ILAs. The Recommendation Engine uses all this information to build a user profile and detect similar profiles from where to build a list of recommended additional activities to recommend to the user.

6. Methodology

For the design and development of our proposal we have chosen to adhere to the action research methodology [61, 62]. Action research consists in solving a particular problem by directly working on it and does a number of iterations of development and evaluation.

For the evaluation part, we are planning on organizing a couple of rounds of focus tests, where users from the academia and from the private sector will be invited to access the platform and use it for a short period of time (2–4 weeks). After that time, we will ask them to answer a questionnaire evaluating the platform. For recruiting users, we have direct contact with UPC-BarcelonaTech and the University of Salamanca (USAL) for academic users and a number of small and medium enterprises (SMEs) in the area of Barcelona that have participated in tests of previous projects of ours that are willing to help us recruiting users from the private sector. After each round, we will ask them to answer some questions evaluating the platform. These questions will focus in a number of indicators for the platform like:

- Usability: intuitive and responsive interface, efficient and clear presentation of information,
- Induced overhead for the learners: time dedication required for keeping the portfolio up to date,
- Perceived benefits from using the platform.

Apart from the answers to the questionnaires, the

usage statistics that we will record for the duration of the tests will provide further data for our evaluation. These metrics include, but are not limited to:

- Number of visits of a learner,
- Time spent per visit,
- Number of ILAs introduced per learner,
- Number of ILAs edited after being introduced in the platform,
- Number of showcases created,
- Number of recommendations adopted,
- Number of social interactions,
- Number of direct evaluations of activities.

Again, our experience with the TRAILER project has shown us that these two sources of information can provide a fairly accurate depiction of the learners' perception of the framework, both in terms of interest in the process and the platform's usability.

7. Conclusions and future work

In this paper, we have established the importance of IL as an integral part of the educational process and we have presented our work-in-progress in designing and providing a portfolio framework that promotes, supports and evaluates informal learning. Our previous involvement in the TRAILER project funded by the European Commission means that we have already gathered valuable experience in designing such a framework. In the portfolio design we have used a new approach based on collaboration to create a knowledge base, not only capable of producing an evaluation of a learner's activity and their progression towards attaining certain competences, but to also provide recommendations based on the activity of their peers. A recommendation engine is responsible of creating these recommendations based on metrics. These recommendations will provide learners with personalized recommendation for further ILAs.

One of our goals for the proposed portfolio is that it must be intuitive, with low overhead in terms of user implication and with a UI that will offer immediately useful information and feedback to the learner. The UI provides several methods to gather ILAs from external sources avoiding the time consuming task of introducing ILAs manually. ILAs may be enriched once they are stored on the system by the ILAs owner, by other users of the framework in a social, recommendation or evaluation process, or automatically by the recommendation, evaluation and social tagging engines of the portfolio architecture.

We propose the creation of a competence catalog as a component of the portfolio. Our proposal is to use a very generalized and simple initial competence list and let the learners define their own competences. These newly defined competences will be added in the centralized list and help populate it. This set of competences includes the particular learners interests as user specific competences and more general and accepted competences established by supervisors.

We are at the point of concluding the initial design phase for the framework. Our next steps would be the implementation of a working prototype based on the ideas and directions detailed here. This prototype will initially connect to a limited number of popular ILA sources like YouTube. This will permit us to run a couple of pilot phases six months apart, in order to gather learner feedback and fine-tune the processes and the interface all the while expanding the list of connected IL sources.

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