Chapter 7
Resources Beyond Content for Open Education

Frans Van Assche, Victor Alvarez, Douglas Armendone, Joris Klerkx, and Erik Duval

Abstract While many innovations in Technology Enhanced Learning (TEL) have emerged over the last two decades, the uptake of these innovations has not always been very successful, particularly in schools. The transition from proof of concept to integration into learning activities has been recognized as a bottleneck for quite some time. This major problem, which is affecting many TEL stakeholders, is the focus of the 4-year iTEC project that is developing a comprehensive approach involving 15 ministries of education and is organizing a large scale validator with more than a thousand classrooms. This chapter reports on how the information provision on events of interest in learning as well as on persons that can contribute to learning activities, supports novel scenarios and is key for the introduction of open education in the K12 education.

Keywords Persons • Events • Repository system • Interoperability • Learning

Open Education for Schools

While Illich's (1971) vision of deschooling society did not materialize for many reasons—including the fact that taking care of youngsters is institutionalized in our western society where in many cases both parents work—many of his ideas such as the "educational webs" are more relevant than ever. Similarly, the ambient intelligent vision for education presented in Ducatel et al. (2001) was unrealistic. However, it was indicative of a shift to different forms of more learner-centred education. Nowadays ICT-facilitated approaches include personalization (García Hoz 1981),

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differentiation, individualization, self-regulated learning, the flipped classroom and ambient schooling (Van Assche 2004). The current focus on proactive, communicative, and participative pedagogical strategies, as well as the emphasis on social learning (Brown and Adler 2008) can be seen as a natural evolution of the learning-centric paradigm and a means to provide open access to a wealth of learning resources. Indeed, instead of one teacher for many students, the use of different kinds of resources (including human resources) is facilitated by ICT and open education in the educational process of a single student.

Open education traditionally relies heavily on the availability of open educational material such as provided in Open Educational Resource repositories (see e.g. the Learning Resource Exchange[1] and the Open Discovery Space[2] or GLOBE[3]), and more recently in Massive Open Online Courses (MOOCs). However, just providing open access materials is not sufficient within a schooling context, neither does it utilize the full potential that modern ICT offers. In a way, in today's school setting, a real learner-centred approach, including personalization, differentiation, or individualization, might turn out infeasible from a socio-economic perspective. Indeed, following Herbert Simon's (1956) *satisficing* principle, policy-makers are compelled to consider what is "good enough" education due to budgetary constraints. Hence, the challenge is to make the shift towards a more learner-centred approach within the socio-economic context of today.

Therefore, if we seek to make education for youngsters more open and more personalized, differentiated, or individualized, institutional education needs to explore *alternative interactions* that can be delivered in a cost effective manner.

Richer Interactions Through Resources Beyond Content

The rationale for looking at interactions when aiming to provide open education for youngsters is based on the observation that social presence enhances learning (Swan and Shea 2005) and that our understanding of content is socially constructed (Van Assche 1998). An informal model that illustrates the interactions in learning is given in Fig. 4.1 of Chap. 4. Typically, a learner interacts with a tutor (usually the teacher), a subject expert (usually the teacher), co-learners, education material, and the world outside the close educational environment. In a way, the learning can only be influenced through these interactions.

However, current systems are mostly focused on providing access to learning material and getting access to educational resources beyond content remains problematic. Despite social systems such as Facebook or even professional networks such as LinkedIn, or researcher networks such as ResearchGate, it is very hard to

[1] http://lreforschools.eun.org

[2] http://www.opendiscoveryspace.eu/

[3] http://globe-info.org

find a **person** willing to help with French pronunciation, a tutor for a mathematically gifted child, or co-learners in contemporary history, beyond the persons known from and immediately available in the school context. Similarly, it is not easy to find **events** happening in the world that could contribute to a valid learning experience. This vision of future education suggests increasing the current scope of openness, emphasizing the importance of providing open access to resources beyond content.

At the same time, harnessing new (forms of) interactions may have a profound impact in education and lead to increased engagement in the learning process (Beare 2013; Beldarrain 2006). Referring to the same interaction model, engagement can arise from the person, material, or environment one interacts with and/or the interaction conduit itself. From the early Web for Schools (Van Assche 1998) project up to recent TEL projects such as the Stellar project, research has pointed to this engaging potential of ICT.[4]

Therefore our project explored to what extent interactions other than those found in the traditional classroom can positively affect educational attainment and enhance engagement; specifically by making information about Persons and Events available that can enhance such interactions. By doing so, we seek to facilitate the exploration of ICT enabled *new scenarios*, *new roles and situations in the learning process*.

The Persons and Events Directory

The Persons and Events (P&E) Directory is part of the iTEC project. iTEC, which stands for Innovative Technologies for an Engaging Classroom, was a large-scale pilot led by European Schoolnet (EUN)[5] and involved a network of Ministries of Education, universities, leading ICT vendors, innovative SMEs, TEL researchers, teacher educators and experts in school validations and pedagogical evaluation. The aim of this collaborative project was to produce meaningful pedagogical scenarios for supporting teaching and learning in future classroom practice.

The iTEC P&E directory was designed by our research group at KU Leuven to allow registered users to find other persons, within and outside the school context, who can contribute to a learning activity and to find events that are of interest to a teacher or students in their learning activity. An illustrative user story is as follows.

Belgium has two astronauts that have visited the International Space Station (ISS). The latest, Frank De Winne, remained six months in space and was commander of ISS expedition 21. The MoE of Flanders, keen on raising interest in science, has asked him to register as an expert in the Persons and Events Directory. Mr De Winne accepted with pleasure and he agrees to be available for six chat

[4] In the Stellar 'Big Meeting' of February 2012 there was only one factor mentioned by all business stakeholders: the engagement potential of TEL.

[5] www.eun.org/

sessions with students and their teacher. The MoE sets up six chat events and registers them in the P&E directory. A few days later, Chris, a science teacher, is reading the iTEC scenario "Beam in the expert". She considers this an interesting scenario and consults the P&E directory, easily identifying experts that speak Dutch and have expertise in science. She identifies Mr De Winne and selects one of the six chat sessions that he is offering. The pupils prepare very well and during the chat session, interesting questions arise such as about the smell in the ISS if you don't have fresh air for six months…

While professional social networks such as LinkedIn were readily available, they were inadequate for our purpose; i.e. to find persons in a European multilingual network based on country, the language(s) they master, country, subject, and ways to contact them. Within the iTEC project, search options were investigated, leading to the faceted search for persons as illustrated in Fig. 7.1 (for privacy reasons the data is fictitious). Here, the search is effected using a number of filters shown on the left. The data available for the person is shown on the right. Users can indicate whether they know persons in the directory and whether they trust a person's judgement. This information is used to make recommendations to the user as elaborated in Chap. 6.

Similarly, events from across Europe can be found based on country, language, subject, event category, and event place. This is illustrated by Fig. 7.2. These events may come from different sources (see next section) and be of different types.

The interface of the P&E directory has been translated to 9 languages, and through the use of multilingual vocabularies, users can also access most of the data

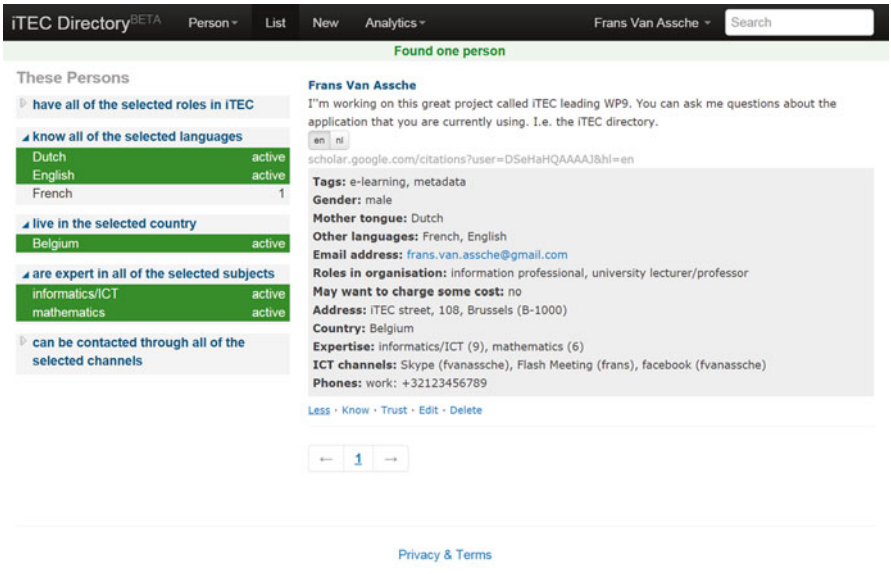

Fig. 7.1 Finding persons

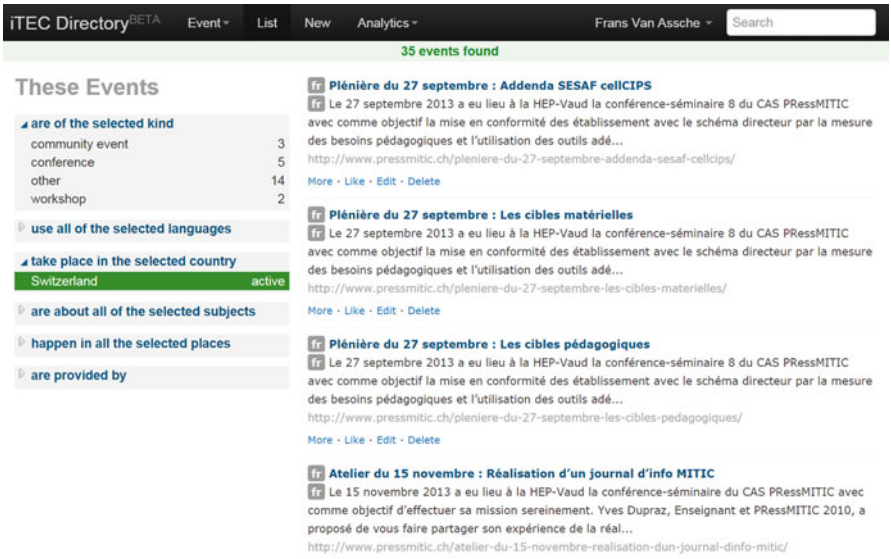

Fig. 7.2 Finding events

in their own language, while they need to be entered only once in the user's mother tongue. Also, some social data (i.e. that one likes an event) is gathered, which is then used in the aforementioned recommender system.

Technical Implementation

The implementation can be divided into three separate technical concerns: (a) how the data on Persons and Events is obtained from different sources, (b) how this data can be searched and presented, and (c) how the data can be accessed by other components.

Federated Access to Learning Resources

The Persons and Events Directory has a federated architecture. As such, the directory obtains its data from different sources depicted at the right of Fig. 7.3. The Persons and Events Directory reads RSS channels from existing educational repositories such as from Ministries of education, European portals and educational institutions. In addition, the Persons and Events Directory is harvesting from other

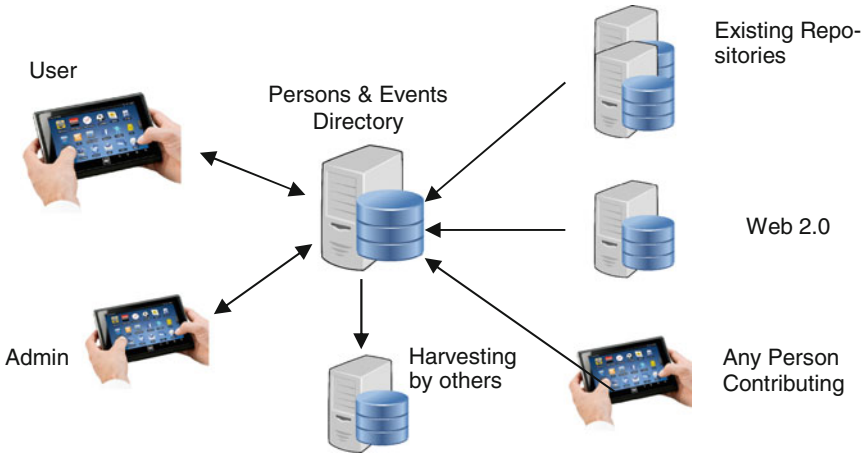

Fig. 7.3 The federated architecture of the Persons and Events directory

repositories such as the iTEC SDE repository[6] which scrapes existing web sites, transforms it into web 2.0 data structures and exposes it in either RDF triples or JSON data structures. As an example, events are scraped from CEN/ISSS, the open education portal, etc. Finally, registered users can also submit new entries to the directory.

The technical implementation involves the following components:

- A search engine for Persons and Events, implementing the combination of a full text search with a faceted search.
- An RSS harvester for the ingestion of events from external sources.
- A harvester for ingesting collections of iTEC formatted events from other iTEC components, such as the SDE repository.
- A harvesting target such that other authorized systems can harvest information from the Persons and Events Directory. This includes for example other subsystems from iTEC as well as any educational site or repository
- A vocabulary handler that ingest and handles multi-lingual vocabularies from the Vocabulary Bank for Education[7] (VBE).
- Facilities to manually submit new and enrich harvested entries about Persons and Events.

[6] http://www.itec-sde.net

[7] http://aspect.vocman.com/vbe/home

- A usage data logger implementing an application profile of the Experience API[8] (xAPI) as well as analytics tools.
- Visual analytics tools that indicate, in an objective way, the real figures for the total traffic and activity registered in the directory.

Facetted Search Engine

The search options adopted and investigated under the framework of the iTEC project has led to a faceted search for Persons and Events, which uses filters that are usually not available on other established social networks. These search filters allow persons in a European multilingual network to be found based upon a specific country, by the language(s) they master, subjects of expertise and a series of contact channels to reach them. Similarly, events from across Europe can be found using the following filters: country, language, subject, category, and place. The events may also come from different sources and be of different types.

Integration with Other iTEC Activities and Learning Tools

The Persons and Events Directory has been integrated with other iTEC tools, i.e. by harvesting other iTEC sources of information, such as the iTEC SDE repository. It also provides a RESTful API encoded as JSON strings over HTTP to access the information about Persons and Events. Consumers of the P&E API need to be able to send HTTP POST requests and be authenticated.

iTEC tools have also been classified in groups, and the P&E directory is now part of iTEC Educational Cloud (see Chap. 4) along with the Composer (see Chap. 5), the Widget Store (see Chap. 8) and the SDE (see Chap. 6). However, these various iTEC technical outputs can be further integrated for the benefit of iTEC users and the educational community. It seems, teachers and educational experts could take advantage of a more holistic and comprehensive view of the various iTEC tools, and multiple products, inside and outside iTEC. They could also benefit from the integration of the whole set of technologies available and the current information in P&E Directory.

Evaluation

The evaluation of the Persons and Events Directory addressed different dimensions: (a) the potential benefits for stakeholders, (b) the technical feasibility, (c) the usability, (d) usage and social use, and (e) other operational considerations.

[8] http://www.adlnet.gov/tla/experience-api/

Potential Benefits of the iTEC Persons and Events Directory

An initial analysis carried out with stakeholders revealed that the P&E directory could have a series of potential benefits for teachers and students attending a teacher training institution and for people in the education area in general. Although the Persons and Events Directory is already being used in real life situations with real life data, it is a proof-of-concept system and therefore the evaluation not only looks at the current system but also at the potential it has.

The potential benefits, split in three groups for better readability and comprehensibility, are enumerated as follows:

Find Resources to Improve Your Teaching Practice

1. Find support in developing advanced learning design skills, while improving the use of information and communication technologies (ICT) in the classroom.
2. Identify and make use of events during learning activities: a way to make students more interested in the topics they are studying.
3. Identify trainings and continuing professional development (CPD) opportunities in your region.

Promote Your Initiatives and Publish Your Resources

1. Gain visibility by promoting a favourite technology, service or technical tools you use in the classroom.
2. Promote self-organised events or activities taking place at your school (e.g. competitions, fairs, etc.).
3. Event organizers can promote regional and national events.
4. Post links to videos through which you share your experience and teaching practices.

Become a Member and Benefit from Networking

1. Be part of a dynamic multi-cultural community. Easily identify and contact (or be contacted by) peers and experts outside the school (locally or from other countries), willing to contribute to teaching and learning activities.
2. Persons traditionally not involved in the learning activity can more easily express their willingness to participate in the learning process.
3. Become part of a teachers' network and be contacted to take part in a wide range of training opportunities from across different European Schoolnet (EUN) projects (including workshops, courses, summer schools, and online or face-to-face events offered at the Future Classroom Lab). Teachers may also receive invitations to participate in new EUN projects.
4. Be invited to become a certified Future Classroom Ambassador in your country.

In order to evaluate the influence of these factors and enable us to better understand their potential benefits for teaching and learning, we developed new information models and designed a combined quantitative and qualitative evaluation method. The following sections deal with the evaluation of the pilot phase and elaborates on the lessons learned from the maintenance of the iTEC Persons & Events directory. This study allowed us to draw first conclusions about technical feasibility, usability and other factors that should be considered for a successful deployment of the P&E directory.

Technical Feasibility

The proof of concept development, allowed us to confirm the scalability of the system, and how it could easily be developed into a production system, due mainly to the harnessing and combination of proven scalable technologies. The concept of a *federated architecture* is today very well understood and has been in operation for some years. See for example: (Klerkx et al. 2010) and (Van Assche et al. 2009). However, in contrast to these systems, the federation presented in this chapter, uses simple RSS channels as well as simple JSON exchanges. Other technologies used are relational database systems as well as SOLR[9] for full text indexing and the faceted search. *Semantic interoperability* is facilitated by multilingual vocabularies developed in a number of European funded projects, including ETB,[10] CELEBRATE,[11] MELT,[12] and ASPECT.[13] These vocabularies are now available through the Vocabulary Bank for Education (See also section on "Technical Implementation").

Usability Evaluation

Teachers and education experts participating in the pilot study were asked to respond to surveys and provide information about their experience with the P&E Directory. This study was conducted in three workshops and during the final stage of the pilot study. The researchers carried out two different surveys, the System Usability Scale (SUS)[14] (see Table 7.1 for the questions and Fig. 7.4 for the results) and a survey specifically designed to address the assessment of the directory.

[9] http://wiki.apache.org/solr/Solrj

[10] http://etb.eun.org

[11] http://celebrate.eun.org

[12] http://info.melt-project.eu

[13] http://www.aspect-project.org

[14] The System Usability Scale (SUS): http://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html

Table 7.1 The questions of the System Usability Scale

Q1	I think that I would like to use this system frequently
Q2	I found the system unnecessarily complex
Q3	I thought the system was easy to use
Q4	I think that I would need the support of a technical person to be able to use this system
Q5	I found the various functions in this system were well integrated
Q6	I thought there was too much inconsistency in this system
Q7	I would imagine that most people would learn to use this system very quickly
Q8	I found the system very cumbersome to use
Q9	I felt very confident using the system
Q10	I needed to learn a lot of things before I could get going with this system

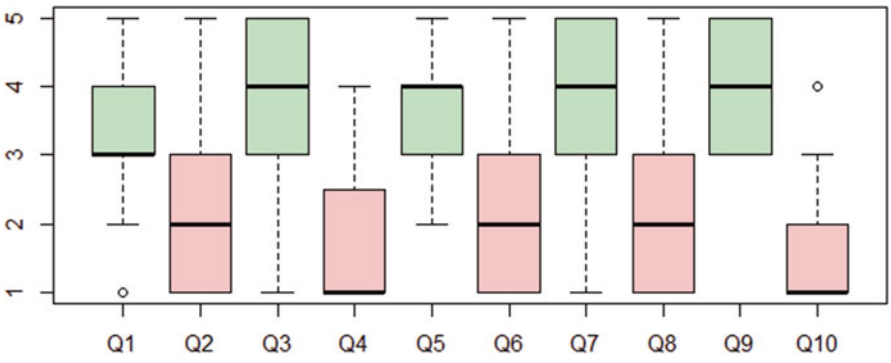

Fig. 7.4 Box plot of answers to the SUS questionnaire

Preliminary study. The usability of the P&E Directory was first evaluated using the SUS during two workshops. Together, these workshops had a mixed audience of 46 participants. The simplicity and proven effectiveness of the SUS has made it a widely used reference in usability evaluation.

By comparing the data of the two workshops, it was possible to observe how the P&E Directory scored much better with teachers than with non-teachers (i.e. authors, counsellors, experts, learners, managers and others) on the question "I think that I would like to use this system frequently". In order to validate the consistence of the answers, an intended user mismatch was introduced in the questionnaire. It is interesting to see that the answers of people that filled in the questionnaire carefully resulted in a much higher SUS score (72.13) than for people with inconsistent answers (59.47). Taking into account the number of valid answers, the usability of the P&E Directory was deemed to be "OK" to "Excellent" using an adjective rating scale.[15]

[15] Determining What Individual SUS Scores Mean: Adding an Adjective Rating Scale: http://www.upassoc.org/upa_publications/jus/2009may/bangor1.html

Similarly, it was clear that the intended audience found the P&E Directory much more usable than the non-intended audience. A closer look also revealed that teachers without previous knowledge of the iTEC project and its set of tools had more trouble to understand the purpose of the P&E Directory, which scored higher with teachers that were familiar with the iTEC approach of scenarios. In addition, the influence of other factors such as: teachers from small countries were more inclined to use resources from abroad than teachers from big countries, can make a European wide choice of resources be appreciated differently. These observations may have an influence on the mainstreaming of the P&E directory.

iTEC workshop. In a second stage of the usability study 18 experts in other areas of the iTEC project were asked to interact and perform tasks with the P&E directory. Following this, they were requested to fill out an online survey specifically designed to address the assessment of the directory as a "proof of concept", rather than a product, thus focusing on the potential benefits when developed into a full system.

In this study, the respondents highlighted the value of using the P&E directory to identify peers and experts outside the school environment who were willing to contribute to teaching and learning activities, over finding information about educational events, or promoting teaching and learning events they are involved in. This finding stressed the importance of forming a community of practice around the P&E directory. It suggests as well that a few actions are necessary to improve the way events are introduced and presented to users in the current version of the system.

In terms of perceived advantages in comparison to using other social networking sites, over 47 % of the respondents remarked the aim on pedagogical purposes and the simplicity to find very particular information about education and educational networking, while 21 % valued the structuring of data, improved search functions and filtering of information.

Final usability study. In the last stage of the pilot study, the user interface of the P&E directory included an evaluation tab with links to an online survey available in nine languages (DE, EN, ES, FL, FR, HU, IT, TR, PT). The following reproduces the final usability report developed at Manchester Metropolitan University and applies only to results obtained for the P&E directory. For a broader view on the impact of the iTEC project, please refer to Chap. 9 in this book.

The majority of the findings reported here were collected via an online survey that was delivered via SurveyMonkey and promoted via various iTEC mailing lists. The P&E survey was open between 21st May and 20th June 2014. Responses were included only if respondents had completed the survey at least as far as question 5 (the first question directly about the use of the P&E Directory).

Across all languages, a total of 132 respondents completed sufficient questions to be included in the analysis. This figure represents 48 % of the total number of registered P&E users at the time of the survey. 65 % of respondents (n = 132) were teachers; 12 % were teacher educators; and 7 % were experts. Head teachers (5 %); counsellors (5 %); managers (3 %); trainee teachers (2 %); learners (1 %) and authors (1 %) were also represented. Additional data was obtained from a small number of teacher comments relating to the P&E Directory in notes/transcripts from technology focus groups and pilot case studies.

The P&E directory and social media. Among survey respondents, Facebook was the most commonly used social media network for professional purposes (83 %; n = 132). Around half the respondents used Twitter (51 %) and a slightly smaller proportion used LinkedIn (42 %). When asked what, if any, potential advantages the People and Events Directory offered in comparison to other social networking sites (e.g. LinkedIn), by far the most frequent response was that it was focussed on education and the needs of teachers (47 responses):

"Sites as such LinkedIn are too general. This is for teachers."
"It is a more specific network it is connected to education."

Twelve respondents felt that the structure of the P&E Directory was better than existing sites:

"Easier to sort and find people."
"The people network on the P&E Directory is structured"

Other benefits mentioned were: allowing easy contact between people involved in iTEC (and other European projects) (6 respondents); the quality of information provided (e.g. currency, consistency and depth of detail) (3 respondents); the range of contact options offered (2); and the fact that people listed were likely to be willing to help if contacted (2). Nine respondents said they did not feel the P&E Directory had any advantage over existing social networking sites.

Training and support. 43 % of respondents (n = 132) had used the P&E Directory Manual to learn about the Directory. Around one-third (30 %) had received a training session from a national co-ordinator and 14 % had received one-to-one-support. However, 26 % did not indicate that they had received any training or guidance in using the Directory. 63 % agreed or strongly agreed that the information and support they had received provided all the information necessary to understand and use the People and Events Directory effectively (see Fig. 7.5).

Using the P&E Directory. Overall, respondents (n = 131) indicated that location-based searches were seen as the most useful ways of using the 'events' section of the P&E Directory (see Fig. 7.6):

- Finding information about regional or national events (59 % ranked first, second or third).
- Finding information about local events (59 % ranked first, second or third).
- Finding information about international events (58 % ranked first, second or third).

Other ways of finding events (by audience and subject) were less popular and the facility for respondents' promotion of their own events was seen as the least useful function:

- Finding information about events on particular subjects (48 % ranked first, second or third).
- Finding information about events aimed at particular audiences (44 % ranked first, second or third).
- Promoting events you are involved in (32 % ranked first, second or third).

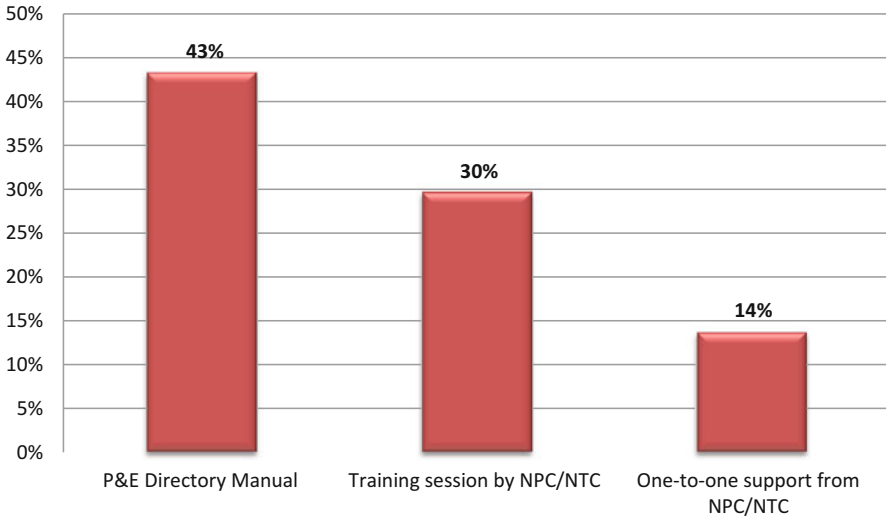

Fig. 7.5 Use of training and support materials and sessions; 132 participants responding to the question: "Which of the following have you used to learn about the People and Events directory?"

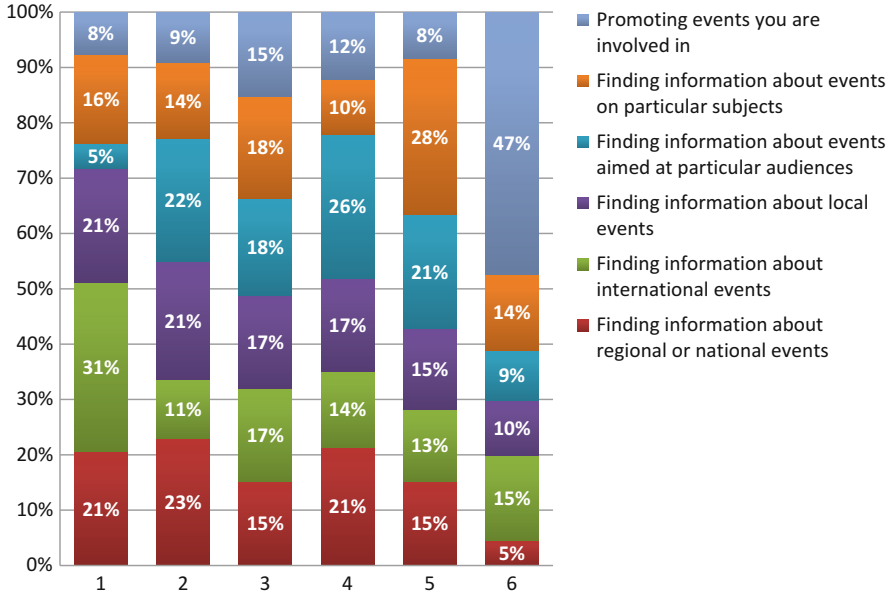

Fig. 7.6 Perceived usefulness of the events section in the P&E directory; 131 participants responding to the request: "Please order the following possible ways of using the 'events' section of the P&E directory from 1 (most useful) to 6 (least useful)"

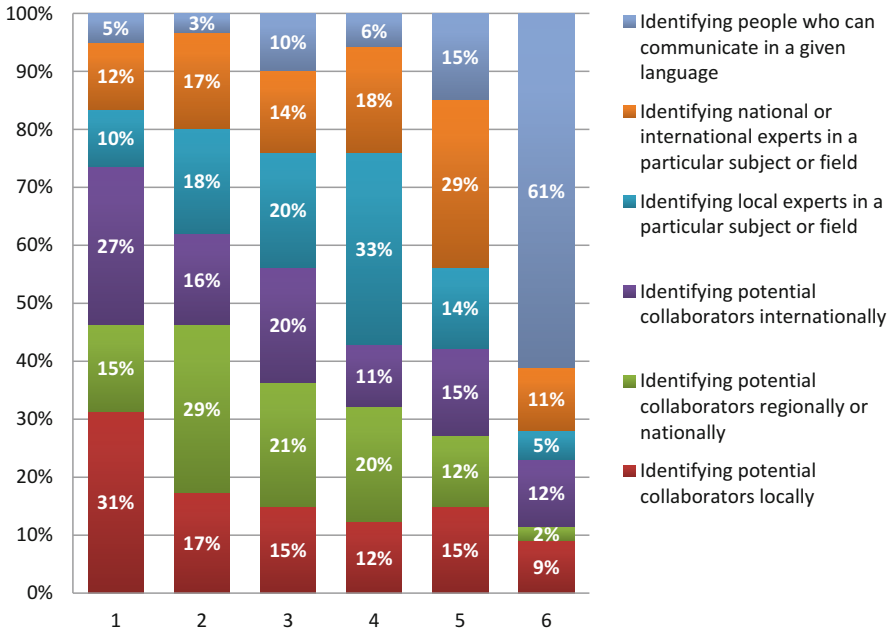

Fig. 7.7 Perceived usefulness of the people section in the P&E directory; 121 participants responding to request: "Please order the following possible ways of using the 'people' section of the P&E directory from 1 (most useful) to 6 (least useful)"

The 'events' section of the P&E Directory had been used by a number of teachers to discover new technologies and design new learning activities (see Fig. 7.7). 23 % of teachers (n = 91) said they had discovered a new technology or learning activity from the teacher videos available within the P&E Directory and 60 % of this group (n = 20) had used this technology or activity within their own teaching, or planned to do so. 20 % of teachers (n = 92) said they had used information or contacts from the P&E Directory to design a learning activity. When asked how they had used information or contacts within their learning design, respondents gave a wide variety of answers including:

"I published information in my blogs, shared by facebook, twitter, e-mail."
"Utilised in the design of a MOOC and also used in the creation of articles on ICT."
"Put my students in contact with an expert in a specific area."
"The inclusion of references to events acted as a guide for tasks carried out within a learning activity (searching, referencing…)."

11 % of respondents (n = 108) said they had attended an event they discovered through the People and Events Directory.

Turning to the 'people' section of the Directory, the facility to identify collaborators, at all levels was seen as the most useful way to use the Directory (n = 121):

- Identifying potential collaborators regionally or nationally (65 % ranked first, second or third).

- Identifying potential collaborators locally (64 % ranked first, second or third).
- Identifying potential collaborators internationally (63 % ranked first, second or third).

The Directory was seen as less useful as a method of identifying experts. This may perhaps be because respondents felt less need to contact experts, or because the number of experts listed was very small. The facility to search for someone who could communicate in a given language was seen as being of limited use:

- Identifying local experts in a particular subject or field (48 % ranked first, second or third).
- Identifying national or international experts in a particular subject or field (42 % ranked first, second or third).
- Identifying people who can communicate in a given language (18 % ranked first, second or third).

Overall, the 'people' section of the Directory appeared to have been less well used than the 'events' section to date. Only 8 % of teachers (n = 91) said they had contacted, or been contacted by, an expert or collaborator they identified through the P&E Directory. Just one of the other stakeholders (n = 16) said they had contacted, or been contacted by, a teacher (or other collaborator) through the Directory. When asked to describe what happened and how they had worked together, two teachers mentioned email and another referred to a seminar. One other stakeholder said they were using WebEx.

Benefits of the P&E Directory. When asked to assume that the Directory had been developed into a mature product with sufficient People and Events available, at least four-fifths of respondents agreed with the following statements (see Figs. 7.8 and 7.9):

- 84 % agreed users become part of a teachers' network (n = 114)
- 84 % agreed teachers and learners have access to videos of ideas, technologies and practices posted by other teachers and experts (n = 113)
- 84 % agreed teachers and learners can more easily contact (or be contacted by) peers and experts outside the school willing to collaborate (n = 113)
- 82 % agreed users can be part of a dynamic multi-cultural teacher community (n = 114)
- 81 % agreed teachers and learners can more easily identify peers and experts outside the school willing to contribute to teaching and learning activities (n = 113)
- 79 % agreed teachers can identify events to use during their lessons (n = 114)
- 75 % agreed teachers and learners can promote self-organized events or activities taking place at their school (n = 114).

The only statement with less than 70 % agreement was:

- 65 % agreed stakeholders traditionally not involved in the learning activities can more easily express their willingness to participate in the learning process (n = 113).

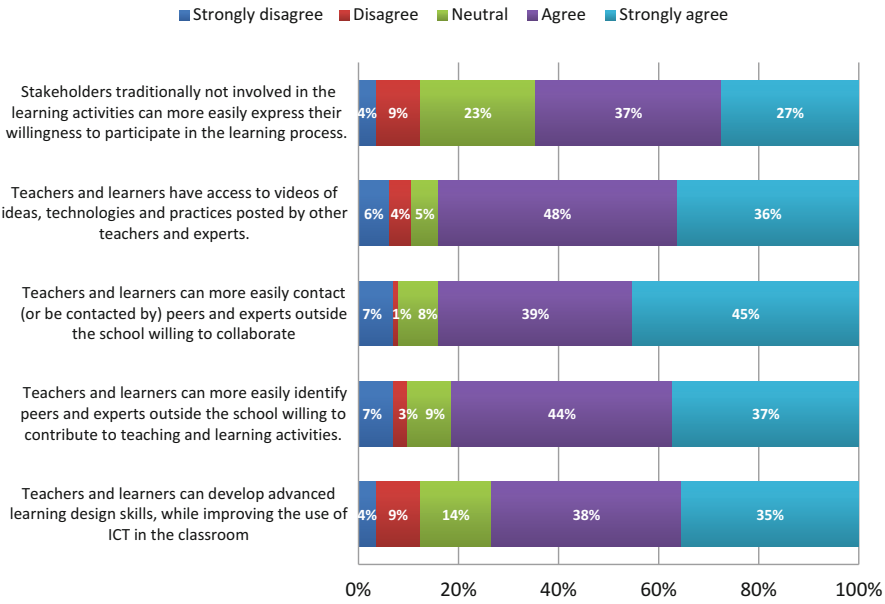

Fig. 7.8 Perceived benefits of the P&E directory (see section on "Open Education for Schools"); 114 participants responding to the request: "Assuming that the directory has been developed into a mature product with sufficient People and Events available, to what extent do you agree…"

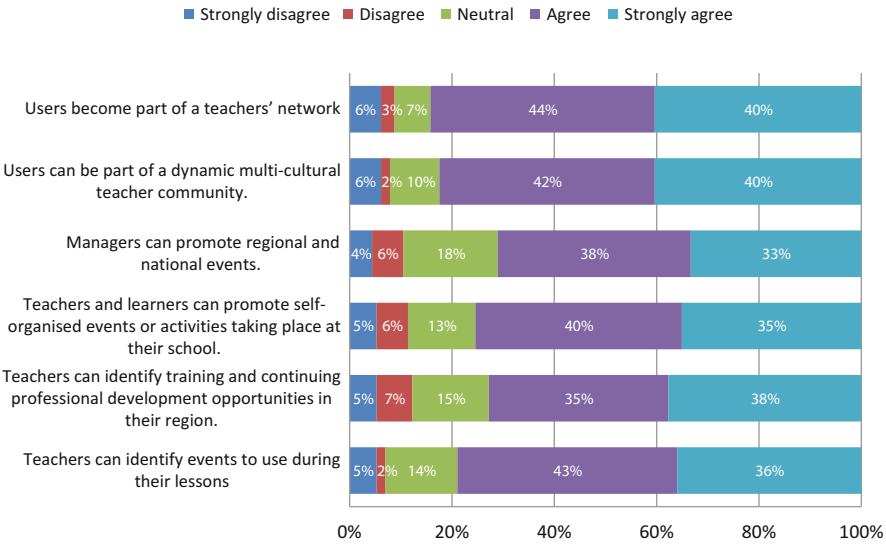

Fig. 7.9 Perceived benefits of the P&E directory (see section on "Richer Interactions Through Resources Beyond Content"); 113 participants responding to the request: "Assuming that the directory has been developed into a mature product with sufficient People and Events available, to what extent do you agree…"

When asked to describe the further potential benefits of the P&E Directory, the most common answer was improving contact with other teachers, and experts with an interest in education (17 responses):

"Creating a big community of teachers, learners and experts."
"Belonging to a large family"

Twelve referred to the capacity of the P&E Directory to act as a platform for sharing innovative ideas aimed at improving pedagogy:

"We can improve our classes by collaborating with schools around Europe."

Closely related to this, nine referred to the establishing of a European community capable of strengthening "interaction between cultures". According to six respondents, another benefit could be improvements in ICT skills as "stakeholders will improve their ICT competences".

Sustainability. 81 % of respondents (n = 106) said they would be likely to use the P&E Directory again, assuming it is developed into a mature product with sufficient people and events available. When asked for what purposes they were likely to use the P&E Directory again, respondents' answers can be categorised as: use of 'People' (either teacher or 'experts') (38 %; n = 86); use of 'Events' (21 %) and to generally improve their knowledge or teaching practice (36 %):

"I want to know more about new technology and to improve my teaching."
"To find inspiration for designing learning activities, to contact experts to invite them to participate in interactive activities with my students, to find partners for collaborative projects,…"
"I will search for events and colleagues for my projects."

When asked why there were unlikely to use the P&E Directory again, just two respondents gave reasons. One felt there was "not enough information and sharing" and the other could not see a use for it, describing it as "inapplicable".

Furthermore, 80 % of teachers (n = 89) said that they would recommend the Directory to other teachers (again on the assumption that it became a mature product). 94 % of other stakeholders also said they would be likely to recommend the Directory to their colleagues and other contacts.

Suggested improvements. Teachers (including head teachers, trainee teachers and teacher educators) were asked how the Directory could be improved to make it more valuable for teaching and learning. The most frequent response was that it needed to be more widely publicised to expand the number of entries (24 responses):

"Be promoted at a national level, better known."
"Including more people."

Seven respondents wanted to see improvements to the interface, in particular changes that would make it easier to use:

"Make it easier and quicker to register People and Events."

A further seven felt the site could be improved through more use of multimedia resources, and perhaps through links to external resources:

"Pictures, an illustration of teachers´ work."
"Examples of good/bad practice should be included."

Six respondents said they would like to see collaboration being more actively supported:

"More opportunities for collaboration."

Teachers also called for improvements to the search facility and categorisation scheme, allowing them to identify useful people and events more easily (5 responses).

"Refining the categorisation of some items in the descriptions of people and events."

Four respondents raised concerns about data security, especially if student contact details were available via the site. Three wanted to see the site translated into other languages.

There were also two people who wanted an alert service to notify them when new entries were added which matched their search criteria.

Experts and other stakeholders were also asked how the Directory could be improved to make it more valuable for people in similar roles. Although a number felt they did not have sufficient experience of using the Directory to be able to comment, six thought that the design should be improved by, for example, making it more interactive and incorporating multimedia content, or simply changing the colour scheme and layout:

"the interface design and it's too formal colour and frame designs … may cause negative bias for some users who may expect… more dynamic and interactive interface."

Three respondents said they would like to see more entries included and a further three thought the Directory could be improved by linking to other services or platforms:

"RSS feeds from other websites that promote training events or learning communities"
"An API for Integrated into other platform—e.g. other things/people you may be interested in after a search."

Other suggestions were an internal messaging or chat system (2 respondents) and more detailed information about people included in the listings (1).

Qualitative data. In addition to the P&E survey, a limited amount of qualitative feedback was received from the technology focus groups (9) and pilot case studies (8). In the teacher focus groups, teachers' use of the P&E Directory had been limited. Most had registered with the site and some had added an event.

Some teachers felt that the P&E Directory duplicates existing tools that provide information about people and events (2 focus groups). Others felt it has potential but needs to include more resources, especially at a local level (3 focus groups). Some teachers experienced technical/administrative issues such as problems logging in (2 focus groups). Suggestions to improve the Directory included a forum/chat facility; allowing RSS feeds; improved categorisation of learning stories/activities to help teachers find relevant resources; a rating system for experts and events; and training and support in the use of the Directory.

Only one teacher in the pilot case studies had made sufficient use of the P&E Directory to be able to comment on the tool, but even they admitted, "I didn't work with it enough to have a well-founded opinion". This teacher thought more content was needed and welcomed the idea of an alert service to make them aware of new people/events that might be of interest.

Usage and Social Evaluation

A visual analytics software tool developed in collaboration with the University of Oviedo was integrated in the last versions of the P&E directory with the goal of allowing obtaining and displaying usage and social information. The pilot study using data analytics was conducted from the 28th of January to the 28th of May 2014. The analytics engine enabled us to compare and contrast the qualitative evaluation by measuring the use of the P&E directory during the pilot phase. Visual analytics were very relevant because they indicate, in an objective way, the real figures for the total traffic and activity registered during the pilot phase of the project. This measure enhanced our understanding of the information and results obtained. From a user perspective, data visualisations can motivate and engage teachers and experts to use the system more effectively.

Usage dashboard. The usage dashboard (see Fig. 7.10) complemented traditional data analytics for a web site with specific usage analytics for the iTEC P&E Directory. Such an approach was meant to make visualizations easily interpretable by any user, particularly for those who were used to working with this type of analytics. The indicators were designed as simple data representations, including the following:

- Session, search and action indicators.
- Data representations for entity creation, search, action, and funnels browse—edition for people and events.

Overall, these figures confirmed previous results, such as the importance of improved search functions and filtering of information. They also highlighted the value of using the P&E directory to identify peers and experts: 4198 searches on 192 persons (ratio: 21.86) versus 2924 searches on 1659 events (ratio: 1.76).

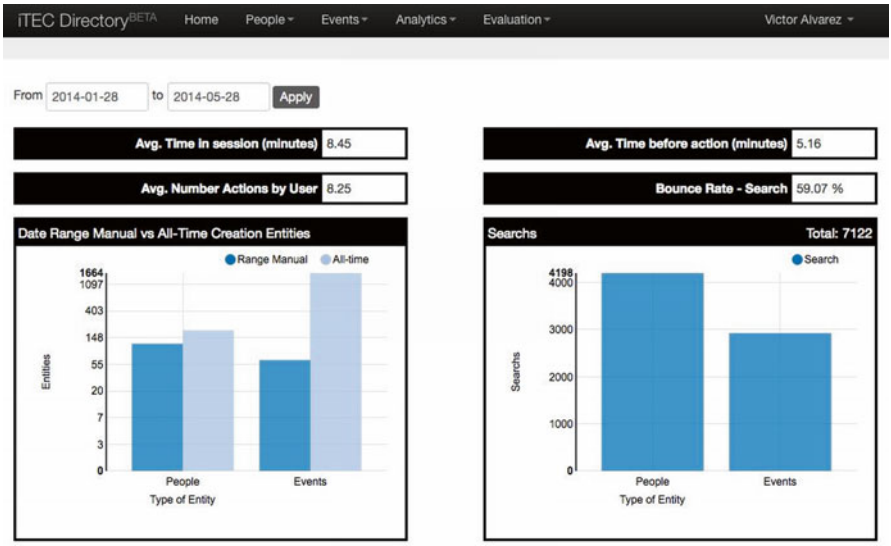

Fig. 7.10 Usage analytics of the Persons and Events directory

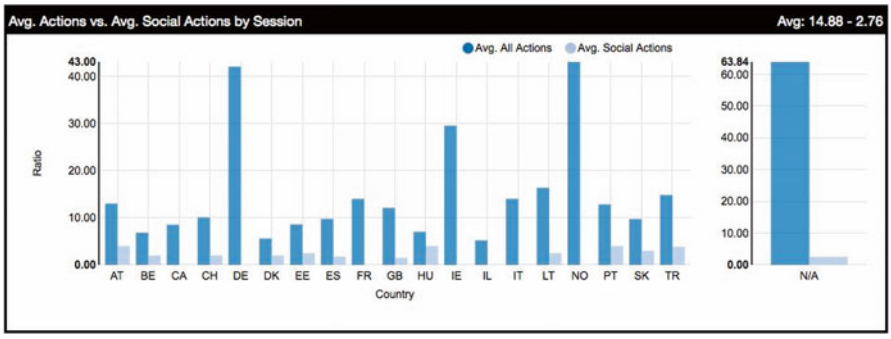

Fig. 7.11 The average number of actions compared with the average social actions

The figures allowed us to map the use of P&E features and the social connections (i.e. know and trust a person, and like an event) made by each participant country.

Social dashboard. The social data dashboard (see Fig. 7.11) aimed at drawing conclusions about how the use of the P&E directory could be related to social variables, with an analysis of country-level participation rates. The design of this dashboard included data representations for:

- "Trust" and "know" connections for people, and "like" for events.
- Entity creation and social action share per country
- Social actions rate with respect to total actions per country.

The results in this area highlighted the overall contributions of some of the partners during the study, and how the average proportion of social actions, 2.77 over 14.80 total actions (18.7 %), were disparate when analysed per country.

Google Analytics. In the final days of the pilot, the P&E Directory enhanced the usage and social analytics dashboards by adopting Google Analytics to track visitors' traffic on the website.

Other Operational Feasibility

In this part of the evaluation, we looked into factors—other than benefits, technical, and usability—that should be in place for a successful deployment of a P&E directory on a larger scale. The main factor was to find and attract good sources for persons and event descriptions. During the project, different categories were investigated and tested with teachers. The most promising event types centred around Continuous Professional Development and involved external subject experts in classroom activities. Teachers then shared their experiences. The most promising person types were those who could contribute to these events. This was investigated with a 16 item questionnaire where each question had a 5 point rating scale. Valid responses were obtained from 46 subjects.

In order to have sufficient Persons and Events available, the harvesting of events from trusted and suitable sources was essential. As such, the establishment of a network of contributing partners was key. In addition, as stated above, the semantic interoperability of harvested resources can be very much improved by an application profile for the RSS feeds as well as Atom feeds. In order to achieve such semantic interoperability it was necessary that the same network of partners would agree on the application profiles and their implementation.

Challenges and Future Developments

The P&E directory was designed to test the hypothesis that providing easy access to resources beyond content can play an important role in facilitating the uptake of ICT in schools. In this section we discuss some possible further developments and challenges related to the gathering, search, and presentation of such resources.

Web-Search of Educational Resources Beyond Content

The P&E Directory was conceived as a specialized educational networking site and some of its features are similar to those in professional networking sites that have a more general scope like LinkedIn. More specifically, it is possible to see similarities

and a common trend with projects focusing on providing social networks for teachers and educational experts, such as the case of Prof-Inet in Quebec,[16] Canada. The P&E Directory was conceived to provide unique and specialized features like federated access to learning resources, and improved search functions and filtering of educational information. Conversations with users of the P&E Directory showed the importance of taking into account and investigating the main characteristics and features provided by similar tools. Users seem to expect familiar interface design principles and features already present in other social networking and educational sites.

Future implementations could make use of P&E users' search information to enrich their profile information, allow them to subscribe and get notifications about persons and events, and create recommendation systems based on pre-configured search criteria. In this way, for example, a teacher interested in Biology events in Switzerland in which French and Italian are the working languages can subscribe and receive notifications about related, relevant persons and events in multiple ways. The P&E directory would perform specific searches on behalf of the users using the database of persons and events and inform them about the results they might be interested in via the website, email or any other electronic means.

Manual gathering or editing of events data was utilized only for the pilot phase implementation of the P&E directory. It could be possible in the future, too, but not as the main method for data collection. Even with automating the ingestion of new events, there will be a role for humans to manually or semi-automatically 'tag' the items with the relevant 'subject', 'location', and possibly 'age range' and 'target audience' labels using controlled vocabularies.

Long-term sustainability of the database can only be secured if the gathering of all data is done using automated processes. Among sources to be taken into account the following have been considered:

- Event databases on MoE's national or regional web portals Visual analytics tools.
- RSS-feeds offered by various educational institutions
- Social media channels
- Websites run by relevant institutions
- Webcasts
- Blogs

Our experience with a variety of RSS sources for Events, has shown how different patterns and XML labelling schemes were used for feeds, making them very heterogeneous and, thus, difficult to harvest and match with existing vocabularies or ontology-based dictionaries. This indicated that semantic interoperability would be greatly enhanced, if an application profile could be developed for the RSS specification targeted at Events for learning.

[16] http://www.prof-inet.com/a-propos-de-nous/qui-sommes-nous/

Innovates Approaches to Data Exploration and Collaboration

The Persons & Events directory set a precedent for federated information sharing and peer networking that could be applied in a variety of educational settings, as well as in science and other fields, using a wide range innovative technologies.

An example of this is ConferExplore (Alvarez et al. 2014), a research effort from the HCI group at KU Leuven concerned with exploring the use of novel techniques in information visualisation and augmented reality to empower data exploration and collaboration in scientific events. It displays a network visualisation of persons (authors) and events (conference talks and presentations) to allow discovering of information and facilitating networking among attendees (see Fig. 7.12). This setup has two main purposes: (i) giving participants an overview of the talks and papers presented at the conference and their authors, and (ii) allowing participants to interact with visual data, discover new papers, and enable peer networking and collaboration. In spring 2014, ConferExplore became the official application of the Tenth Joint European Summer School on Technology Enhanced Learning.[17]

Fig. 7.12 A participant of the JTEL Summer School 2014 using ConferExplore to search scientific information and connect with their authors

[17] http://www.prolearn-academy.org/Events/summer-school-2014

Conclusions

Recent decades have brought a shift in the vision of education towards more decentralized, learner-centred and collaborative approaches. This view has found support from ICT applications, which currently facilitate proactive, communicative, and participative pedagogical strategies. Although educational technologies provide the means to go beyond the classroom settings, the main focus has been traditionally put on providing access to learning materials, while sharing educational resources beyond content remains a problem.

iTEC was a large-scale European pilot that increases the current scope of openness and emphasized the importance of providing open access to resources as a means to facilitate the uptake of ICT in education. One of the available outputs of this project is the iTEC Persons and Events (P&E) Directory, which enables the extraction of information from existing repositories and uses semantic-enhanced information to combine data from multiple heterogeneous sources and enhances search results through filtering.

The successful integration of open resources into learning activities depends largely on establishing an educational network. The P&E directory has already enabled a community of practice where users perform over a hundred daily searches to find persons and browse events that can contribute to their learning activities. The initial evaluation confirms the improvements over existing networks, asserts the interest of teachers, and provides an overview of the benefits of integrating the P&E directory into everyday educational practice.

Feedback on the P&E Directory demonstrates the enthusiasm among iTEC teachers for greater collaboration locally, nationally and internationally to enable them to improve their knowledge of new pedagogies and technologies and to help create a community of innovative teachers who can support each other. Although the P&E Directory was felt to duplicate existing social media networks to some extent, there was notable enthusiasm for a dedicated portal for teachers and educators. There may be potential for other educational 'experts' to play a role in such a community, but the limited number of experts currently available in the P&E Directory meant it was not possible to explore this possibility. Teachers were also keen to find new resources to use in their teaching and felt that such a community offered them a possible means to do that.

Although the P&E Directory has not been widely used to date and feedback is preliminary, responses suggest that interest in using of the Directory to find 'events' (in the traditional sense) is limited. However, teachers do see a value in using it to identify other teachers they can work with and to find resources that can be incorporated into their teaching and can support their professional development. Of course, this is dependent on sufficient collaborators and resources being available through the Directory.

The issues addressed during the project provide the foundation to identify areas for future work. Our experience using a variety of sources for events shows the difficulty of harvesting and matching existing information with ontology-based

dictionaries, and highlights the importance of using metadata and application profiles to improve semantic interoperability. The strategy towards a further integration of the P&E directory with other educational services includes the development of "The Future Classroom Toolkit", which will integrate the key elements from across the iTEC project with other toolkits to provide a series of activities, processes, resources, tools and guidance. In parallel to the development of this toolkit, the project has developed a teacher continuing professional development programme to support the development of future classroom scenarios and learning activities.

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