

Chapter 2

The *SSW4LL* Format

Abstract This chapter develops the characterisation of a PLE as a LLL tool by detailing the *SSW4LL* (*Social Semantic Web for Lifelong Learners*) format. After an overview about the aims, possible scenarios and elements of the *SSW4LL* format, a motivated choice of adult lifelong learners' needs that *SSW4LL* aims to meet is developed. Subsequently, the chapter illustrates the learning paradigm and strategies that underpin *SSW4LL*. Then, the *SSW4LL system*, the technological architecture, is presented as a whole made up of components of formal and informal learning environments. The formal learning environment is devised by Moodle 2.0; a description and an evaluation of Moodle 2.0 features are provided, with a focus on the potential of its conditional activities as a suitable mechanism of learning adaptation. Concurrently, this part identifies the benefits of Felder–Silverman's learning style model, which was selected as the most suitable learning style model for the use in LMSs. The elements of the informal learning environment, Semantic MediaWiki, Diigo and Google+, are presented and their implications within the *SSW4LL* format are discussed. The next section of the chapter deals with the organisation of the format: the resources needed a user case scenario, and a flow chart of the steps of the format implementation are outlined. Finally, a SWOT analysis provides evaluation elements for the format.

2.1 Overview

The *SSW4LL* format aims to provide a learner-centred framework to support the characterisation of adult lifelong learners' PLEs through implicit and explicit tools of personalisation. The format is suitable for adult lifelong learners in general, rather than for one specific target within, and for the development of all knowledge domains. Further, the *SSW4LL* format supports mobile learning, but ubiquitous learning features (Leone & Leo, 2011) could be implemented as well, as an extension.

The synergy of formal and informal learning is realised through the smooth integration of the different technological components, the light e-moderation of the learning environment by a facilitator, the support of a technical e-tutor and the continuous enrichment of the initial learning resources (formal environment) by social software and Social Semantic Web tools (informal environment).

The *SSW4LL* system, the technological architecture, is made up of Moodle 2.0 integrated with an adaptive mechanism (conditional activities), as the formal learning environment component, and of Semantic MediaWiki, Diigo and Google+, as Social Semantic Web tools and informal learning environment elements.

As a whole, the *SSW4LL* format offers an adaptive (Oppermann & Simm, 1994) modular, flexible and integrated architecture, compatible with future Moodle releases.

2.2 Needs Analysis

In relation to the European reference framework of key competences for LLL (European Parliament and Council of the European Union, 2006) and to the results of the EU survey on adult education (AES) (European Commission, 2011),¹ the *SSW4LL* format can contribute to:

1. learning to learn;
2. form active citizens, that is individuals who are engaged in the development of the multiple dimensions of citizenship, beyond knowledge towards the enhancement of competences and attitudes by experiencing active participation in different contexts;
3. personalised and flexible learning;
4. facilitate learner-centred technology-enhanced learning;
5. promote inclusion;
6. improve digital skills;
7. improve social skills.

2.3 Learning Paradigm and Strategies

The *SSW4LL* format is devised to personalise learning in terms of self-organisation by adult lifelong learners working with the support provided by the facilitator, the adaptive mechanism, the technical e-tutor and the peers (Leadbeater, 2004). In this format, personalisation aims to valorise learners' full potential and to empower individuals through knowledge sharing and co-construction. Learners are active co-designers of the learning experience (Maharey, 2007). Consequently, rather than consisting in *learning work*, learning becomes a *learning adventure* (Leo, Manganello, & Chen, 2010), that is a learner-centred, holistic experience which involves a complex, continual, chaotic and co-creative process.

¹See Sect. 1.1.

The format is developed on the background of andragogy (Knowles, 1970) and socio-constructivism (Varisco, 2002; Vygotsky, 1986) theories. Learning is negotiated between the facilitator, the learners and the learning material, and expertise can be located beyond the formal setting through learners' PLEs (Drexler, 2010). In this way, networked learning opens to peer-to-peer scaffolding (Bruner, 1960; Corneli & Danoff, 2011), is made possible by social software, is process-based, experiential (Kolb, 1984), anchored in and driven by learners' interests and, as a result, promotes self-regulated, independent learning (Zimmerman, 1990). Learners enter the learning path with a great diversity of experience, are life-centred, task-centred or problem-centred, and are motivated by internal self-esteem, recognition, better quality of life and self-actualisation (Knowles, 1970).

Herein, a PLE is a concept that helps to view the subject as a landscape as well as individual pieces of information. A PLE consists in a group of techniques and a variety of tools to gather information, explore and develop relationships between pieces of information, to communicate and collaborate (Leone & Guazzaroni, 2010). Information and knowledge reside in digital sources (locally produced files and notes, Internet/Intranet, e-learning courses, reference sites, text/audio/video/graphics files, shared presentations, RSS feeds) and in non-digital sources (books and journals, classroom-based courses, professional meetings, live interaction with colleagues, friends and family). A PLE, at the same time, develops and is fed by autonomy, pragmatic, relevance, building on prior knowledge, goal-directed approach (Leone, 2009).

2.3.1 Learning Strategies

The *SSW4LL* format can be developed through the following strategies:

- brainstorming (in Moodle forums, and in Google+ by posts, huddles and video hangouts);
- problem solving;
- collaborative and cooperative learning (in Moodle forums, Diigo and Semantic MediaWiki);
- webquest (which includes cooperative work and problem solving);
- reflection activities;
- learning by doing;
- self-learning, with the support of an adaptive mechanism in the formal learning environment (Moodle).

2.3.2 Evaluation and Assessment

The *SSW4LL* format is monitored through an entry and a final survey, and entry and formative self-assessment tests to evaluate its effectiveness in terms of participants' expectations and satisfaction and achievement of learning goals, respectively. A final cooperative essay or project work provides summative assessment.

2.4 Technological Architecture: The *SSW4LL* System

The *SSW4LL* system is the technological architecture of the *SSW4LL* format. This system is made up of integrated components of formal and informal learning environments. The system has been designed, implemented and successfully validated as a device suitable to provide adult lifelong learners with a dynamically personalised learning environment, and with a sense of ownership and control over their own learning and career planning.

In particular, the design of the framework has been developed considering (Giovannella, 2008):

- the Web used as an environment, where various tools and contents can be aggregated for the construction of a PLE;
- open source, open content, open society and, as a result, adoption of open “machine-readable” standards;
- the learner’s capability of managing his/her learning processes and of configuring his/her e-portfolio as aggregator of personal knowledge and competences (Lubesky, 2006).

In the *SSW4LL* system the formal learning environment is devised by Moodle 2.0, in which adaptive learning is enabled by its conditional activities. The elements of the informal learning environment are Semantic MediaWiki, Diigo and Google+ that allow adult lifelong learners for a qualitative different bottom-up approach to learning (Fig. 2.1).

By fully exploiting Moodle 2.0 adaptation features that in the *SSW4LL* system are based on the detection of learners’ learning styles, this LMS can deploy a personalised scaffolded learning environment for self-regulated learners. Further, social software can be smoothly integrated in the architecture by widgets and by allowing login sessions to never expire.

In the following, a description and an evaluation of Moodle 2.0 features are provided, with a focus on the potential of its conditional activities as a suitable mechanism of learning adaptation. Concurrently, this part identifies the benefits of FSLSM, which was selected as the most suitable learning style model for the use in LMSs. Finally, the elements of the informal learning environment (Semantic MediaWiki, Diigo and Google+) are presented, and their implications within the *SSW4LL* format are discussed.

2.4.1 Formal Learning Environment: Moodle 2.0

All LMSs provide a great variety of features that teachers can exploit to create and deliver online courses (e.g. learning resources, quizzes, forums, wikis, chats, etc.). For this reason, they are commonly used by educational institutions to successfully offer technology-enhanced learning. Nevertheless, LMSs typically do not consider the individual differences of learners and provide very little or, in most cases, no adaptivity (Graf, 2007).

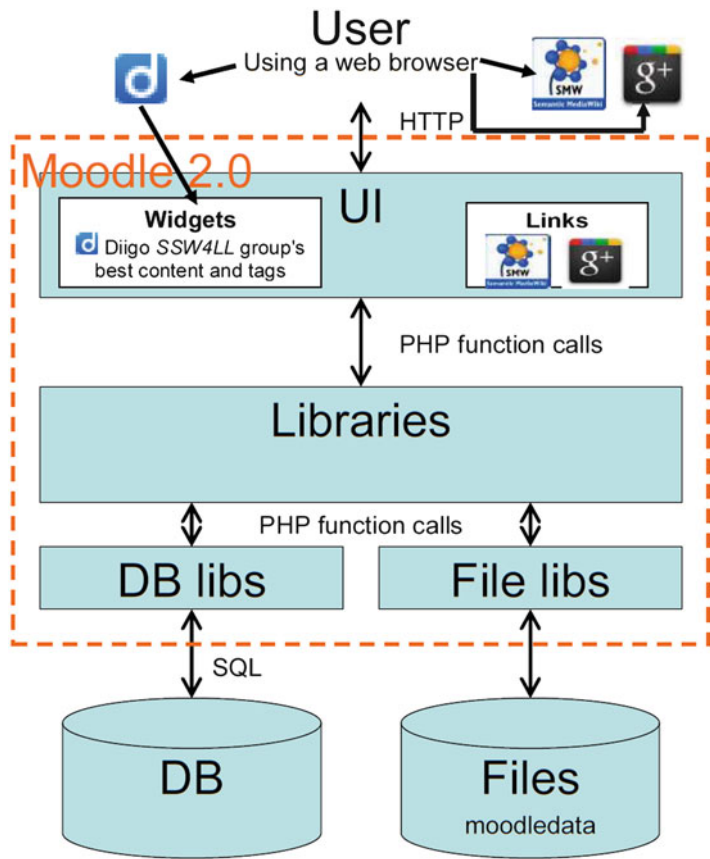


Fig. 2.1 The SSW4LL system architecture

Further, the knowledge society and the current LLL vision have urged a wide range of skills to be developed in lifelong learners: the ability to locate and evaluate information effectively and efficiently; facility with making meaning by aligning new information with prior knowledge and an ability to synthesise, critically analyse and create new information within the context of larger social practices (Lin, 2011).

Starting from these preliminary remarks, two relevant studies and prior direct experience of the author of this research have supported the choice of Moodle 2.0 as the most suitable component for the formal learning environment in the SSW4LL system.

The first reference is Graf's (2007) evaluation of 36 open source LMSs, aiming at assessing the general functionality and usage of LMSs, and their ability to be extended to provide adaptive courses on the basis of students' learning styles.

In a pre-evaluation phase, Graf defined three minimum criteria concerning the usage of LMSs: an active community, a stable development status and a good documentation of the system. An active community shows that the system is supported

and used by many other people, who can provide help in case of need. Thus, an active community indirectly indicates a good quality of the system. A stable development status indicates a reliable and not error-prone product, which is executable in an operational environment. The availability of good documentation is crucial for the installation and customisation of the system, and avoids nearly exclusive dependence on the LMS community. As a forth parameter, Graf considered the focus of the system on the presentation of content as the minimum criterion related to the teaching objectives of the LMS.

Nine LMSs out of the initial 36 met all four criteria, and they were tested in detail through an example course. Finally, to evaluate the nine LMSs, their characteristics were divided into eight categories (communication tools, learning objects, management of user data, usability, adaptation, technical aspects, administration, course management) and several subcategories, which were then weighted and assessed, based on the experience from the usage of each LMS when conducting the example course.

The results of Graf's evaluation highlight that Moodle achieves the best ratings with respect to overall functionality and usage, and adaptation aspects.

Although this evaluation was conducted in 2005,² and many new versions of the investigated LMSs were released in the meantime, Moodle can still be seen as one of the leading LMSs.

Currently, Moodle is one of the most widely used LMSs in the world, by over 31 million students in over 44 thousand sites in over 200 countries (Cooch, 2010), and many universities switched to it as their official LMS in the last few years. Moreover, a second relevant and recent study confirms the validity of Moodle in its new version.³ As a matter of fact, Lin (2011) evaluated the potential of Moodle 2.0 for helping lifelong learners master the wide range of skills and competences that the twenty-first century requires. Lin examined Moodle 2.0 using the following guiding criteria (Cummins et al., 2007) (corresponding features of the LMS are provided in brackets):

1. providing cognitive challenges and opportunities for deep processing of meaning (e.g. by the glossary, forum and quiz modules);
2. relating instruction to prior knowledge and experiences (by the mindmap and questionnaire modules to activate brainstorming and connections);
3. promoting active self-regulated collaborative inquiry (collaboration and social interaction can be embedded in almost every module and block via chat, forum and the improved wiki);
4. encouraging extensive involvement in all language skills (by the RSS feeds block to link authentic reading materials from external websites; by the new repository to easily integrate authentic resources from YouTube and Flickr; by the personal profile and the assignment, lesson, journal, blog and forum modules to develop writing skills);

²Graf evaluated Moodle 1.4.1 version.

³Moodle 2.0 was released at the end of 2010.

5. developing multiple strategies for effective language learning (by the page layout to let students track important information, by the new *My private files* to arrange materials, by built-in comment boxes and the new workshop module);
6. promoting identity investment (by tools available in several blocks and by *My Moodle* page).

As a whole, Lin's review is extremely positive. In the author's view, Moodle 2.0 is a powerful software package whose primary strengths lie in its technical features and in the learning approach that underpins it. Moodle 2.0 enables educational designers to create flexible learning environments based on their students' perceived needs, intentions, cognitive traits and learning strategies. Moodle 2.0 allows facilitators to enhance meaningful learning environments and support lifelong learners in being successful.

Finally, the numerous direct experiences of the author of this research, as a life-long learner, and as an educational designer and a teacher-facilitator, particularly for adult lifelong learners, strongly confirm the advantages of adopting Moodle as an LMS, and Moodle 2.0 in particular.

In brief, the elements that have supported the choice of Moodle 2.0 as the most suitable component for the formal learning environment in the *SSW4LL* system are:

1. it is an open source and flexible LMS;
2. it is supported and constantly improved by an active community;
3. in comparison with its previous versions, Moodle 2.0 offers a new way of managing content (media from sites like Youtube and Flickr can be easily embedded from the text editor), some existing activities updated and improved (e.g. wiki, workshop and quiz), a flexible mechanism to personalise, check and scaffold learners' progress (conditional activities) and improved administration (e.g. a clearer attribution of roles by *cohorts*).

Since Moodle's design and development draws upon social constructionist philosophy,⁴ it is devised particularly for teachers who facilitate their students' learning, rather than lecture to them; for learners to be in charge of their own learning, discussing, collaborating and actively *constructing* their own knowledge; for learners to find their own path, rather than to follow a path set down for them by someone else. Nevertheless, Moodle 2.0 also allows the implementation of different degrees of learning personalisation between the following extremes (a) teachers can choose to roughly guide students, by scaffolding, and let them find their own way; (b) teachers can choose to give them a detailed map with checkpoints they must reach along the way, that is a more structured approach. Further, the determination of learners' learning styles is possible by creating a suitable quiz.⁵

In the *SSW4LL* format, the above-mentioned option (a) and the FSLSM (Felder & Silverman, 1988) are adopted to meet learners' needs and profiles, in accordance with the theoretical background of the format. Furthermore, several researchers

⁴<http://docs.moodle.org/en/Philosophy>.

⁵For Moodle 1.9 a special plug-in can be added <http://moodle.org/mod/forum/discuss.php?d=140054>.

concur on the validity of the FSLSM as the most appropriate to be used in adaptive learning systems (Carver, Howard, & Lane, 1999; Graf, Kinshuk, & Ives, 2010; Kuljis & Liu, 2005; Limongelli, Sciarrone, & Vaste, 2011), as the SSW4LL system is.

Specifically, the FSLSM describes a learner's learning style in very much detail, assuming that each learner has a preference on each of the four dimensions (1) active/reflective, (2) sensing/intuitive, (3) visual/verbal and (4) sequential/global, with assignable values on a -11 to +11 scale. Felder and Spurlin (2005) summarise the four dimensions as follows:

- *active* (learn by trying things out, enjoy working in groups) or *reflective* (learn by thinking things through, prefer working alone or with one or two familiar partners);
- *sensing* (concrete, practical, oriented towards facts and procedures) or *intuitive* (conceptual, innovative, oriented towards theories and underlying meanings);
- *visual* (prefer visual representations of presented material, such as pictures, diagrams and flow charts) or *verbal* (prefer written and spoken explanations);
- *sequential* (linear thinking process, learn in incremental steps) or *global* (holistic thinking process, learn in large leaps).

By using dimensions, instead of types, and a numerical evaluation, the strengths of students' preference for a determined learning style can be evidenced; besides, the FSLSM is based on tendencies, and thus allows to consider exceptional behaviour.

In the SSW4LL format, the 44-question *Index of Learning Styles Questionnaire* (ILS) (Felder & Soloman, 1997)⁶ is adapted into a quiz of four questions, that is one for each of the four dimensions of the FSLSM; each question allows learners to answer by choosing an option between the two provided by a drop-down menu and by attributing a value between 0 and 11 to that option (Fig. 2.2).⁷ A short description of the options is given to support learners' choice.

Even if the original ILS is shortened to facilitate students, its dichotomous structure is kept to force a decision between the two alternatives, thereby increasing the chances that the instrument response will detect preferences.

The feedback provided to the students is a short description of their resulting learning style. In all, 16 different learning profiles have been written as combinations of the eight style categories within the ILS, two for each of the four dimensions. In the back end, the correct matching of the options that learners indicate for each dimension with the final learning profile requires the educational designer to be very familiar with Moodle 2.0 question templates and quiz settings.

The detection of learners' learning profiles is the starter of personalised learning sequences by fully exploiting Moodle 2.0 conditional activities⁸ and the *activity completion tracking* facility (Cooch, 2010).

⁶Available at <http://www.engr.ncsu.edu/learningstyles/ilsweb.html>.

⁷This question format is obtained by integrating a Moodle template of a true-false question with the necessary HTML code.

⁸A workaround to controlling students' access was made available for Moodle 1.9: *activity locking* was a means whereby a teacher could set certain conditions on a task that a learner had to meet before the next task became visible. With Moodle 2.0 this feature is standard, by conditional activities (Cooch, 2010).

Start again

1

Marks: 12.00

Are you an active or a reflective learner?

Active learners tend to retain and understand information best by doing something active with it—discussing or applying it or explaining it to others. Reflective learners prefer to think about it quietly first.

Select a profile

Choose a value between 0 and 11

2

Marks: 18.00

Are you a sensing or an intuitive learner?

Sensing learners tend to like learning facts, intuitive learners often prefer discovering possibilities and relationships.

Select a profile

Choose a value between 0 and 11

3

Marks: 27.00

Are you a visual or a verbal learner?

Visual learners remember best what they see—pictures, diagrams, flow charts, time lines, films, and demonstrations. Verbal learners get more out of words—written and spoken explanations. Everyone learns more when information is presented both visually and verbally.

Select a profile

Choose a value between 0 and 11

4

Marks: 43.00

Are you a sequential or a global learner?

Sequential learners tend to gain understanding in linear steps, with each step following logically from the previous one. Global learners tend to learn in large jumps, absorbing material almost randomly without seeing connections, and then suddenly "getting it."

Select a profile

Choose a value between 0 and 11

Fig. 2.2 The quiz for the detection of learning styles in the SSW4LL format

2.4.1.1 Adaptation Model

In the SSW4LL format, conditional activities aim to allow the educational designer to scaffold learners in accessing learning resources on the basis of one or more conditions. As Fig. 2.3 shows, in the back end of the resources and activities (e.g. a forum) that the designer previously wishes to add to the course, a *restrict availability* area is available for setting. The resource availability can be enabled on a date, on a certain grade for a determined activity or for more than one, on the

Restrict availability

Only available from ? 8 May 2010 ☐ Enable

Only available until end ? 8 May 2010 ☐ Enable

Grade condition ? (none) must be at least % and less than %
 Add 2 grade conditions to form

Activity completion condition ? Post here to follow the Happy thru Fitness module must be marked complete

Activity completion condition ? (none) must be marked complete
 Add 2 activity conditions to form

Before activity is available ? Hide activity entirely

Fig. 2.3 An example of the setting of conditional activities

completion of a determined activity or for more than one. If all these options are set, they have to be met all together to allow learners to visualise and access this activity (i.e. the forum).

The second element to make the learning environment adaptive is the *activity completion tracking* facility, which is the ability for users to mark tasks as “done”. Next to each item on the Moodle course page, a dotted check mark (tick) can be either manually checked by the students, if they feel they have finished a task (they can change their mind), or else the teacher can set it to be checked automatically once the student has actually completed the activity.

In the *SSW4LL* format a suitable and thorough combination of these conditions lets create different learning sequences, in which LOs are proposed according to the students’ learning profiles that are initially detected through the quiz (Table 2.1).

In order to choose the most suitable kinds of LOs for the *SSW4LL* format, the type of learning resources of several e-learning environments for adult learners have been analysed:

1. Graf et al.’s (2010) model: in a teacher-centred (but constructivist in its aims) learning environment for ICT undergraduates, delivered in Moodle 1.9 integrated with an adaptive mechanism based on learning styles, 12 structured kinds of LOs are provided accordingly. Video/audio LOs are not considered.
2. Ghislandi’s model (Leone & Guazzaroni, 2010): in a moderately teacher-centred (but socio-constructivist in its aims) learning environment for PhD students, delivered in Moodle 1.9, a few kinds of textual LOs are scheduled. No strategy nor tools for personalising learning have been adopted.

Table 2.1 SSW4LL LOs sequencing according to the different learning styles

| Dimensions | Learning styles | Learners' features | LOs in SSW4LL |
|------------|-----------------|---|---|
| 1 | Active | They prefer to learn by trying things out and discussing with others about the learned material. | 1. Commentary 2. Animation 3. Real-life application 4. Reading 5. Self-assessment test 6. Forum activity 7. Reflection quiz |
| | Reflective | They learn by thinking and reflecting about the material; prefer to read the content first. | 1. Commentary 2. Reading 3. Reflection quiz 4. Real-life application 5. Self-assessment test 6. Animation |
| 2 | Sensing | They prefer concrete material, are more practical oriented, and like to relate the learned material to the real world; tend to be patient with details and like standard procedures as well as practical problem solving. | 1. Commentary 2. Animation 3. Real-life application 4. Reading 5. Self-assessment test |
| | Intuitive | They like abstract materials such as concepts and theories, prefer open-ended questions, tend to be more creative and like challenges. | 1. Commentary 2. Reading 3. Reflection quiz 4. Animation 5. Real-life application 6. Forum activity |
| 3 | Visual | They remember best what they see—pictures, diagrams, flow charts, time lines, demonstrations and films. Everyone learns more when information is presented both visually and verbally. | 1. Commentary 2. Animations 3. Reading 4. Real-life application 5. Self-assessment test 6. Forum activity |
| | Verbal | They get more out of words—written and spoken explanations. Everyone learns more when information is presented both visually and verbally. | 1. Commentary 2. Reading 3. Forum activity 4. Real-life application 5. Self-assessment test 6. Animation |
| 4 | Sequential | They expect guidance and a linear increase of complexity in learning; they tend to be good in using and applying partial knowledge. | 1. Commentary 2. Reading 3. Reflection quiz 4. Self-assessment test 5. Animation 6. Real-life application 7. Forum activity |
| | Global | They get the big picture of the topic and learn in large jumps, almost randomly; they may be able to solve complex problems quickly or put things together in novel ways once they have grasped the big picture, but they may have difficulty explaining how they did it. | 1. Commentary 2. Real-life application 3. Reading 4. Animation 5. Reflection quiz 6. Self-assessment test 7. Forum activity |

3. SLOOP2desc⁹ model (Fulantelli & Oprea, 2011): in a moderately teacher-centred, strongly hands-on learning environment for high-school teachers and educational designers, delivered in Moodle 1.9, four kinds of LOs are provided, most of which in video. No strategy nor tools for personalising learning have been adopted.
4. Technology Enhanced Knowledge Research Institute (TEKRI) at Athabasca University's PLENK2010¹⁰ model: in a learner-centred, connectivist learning environment, learning resources are unstructured, open and distributed over multiple systems. Learners personalise their learning independently.
5. University of Illinois Springfield's eduMOOC2010¹¹ model: it devises a way to connect and collaborate engaging in the learning process, in which learning resources are unstructured, open and distributed over multiple systems. A distributed knowledge base is built on a LLL background, and learners personalise their learning independently.
6. Limongelli et al.'s (2011) model: in a quite learner-centred learning environment for adult lifelong learners, delivered in Moodle 1.9 integrated with the adaptive plug-in LS-Plan based on learning styles and prior knowledge, only a few kinds of textual LOs are scheduled.

The evaluation of these models has been carried out considering their theoretical approach and the relevance and consistency of the scheme of resources. As a result, the following seven kinds of LOs have been identified for the SSW4LL format:

1. *Commentary* provides learners with a brief overview of the week/module and of the learning material proposed within.
2. *Readings* include Wikipedia items, proceedings, papers, white papers, book chapters, project deliverables about the content of a week/module.
3. *Animations* demonstrate the concepts of the course in an animated multimedia format (videos and ppt).
4. *Real-Life Applications* demonstrate how the learned material can be related to and applied in real-life situations (ongoing and recent projects).
5. *Reflection Quizzes* include one or more open-ended questions about the content of a week/module. The questions aim at encouraging learners to reflect about the learned material.

⁹Sharing Learning Objects in an Open Perspective to Develop European Skills and Competences (2010) <http://www.sloop2desc.eu/en.html>.

¹⁰Personal Learning Environments Networks and Knowledge <http://connect.downes.ca/index.html>.

¹¹Edu Massive Open Online Course <https://sites.google.com/site/edumooc/home>.

6. *Forum Activities* provide learners with the possibility to ask questions and discuss topics with their peers and facilitator. While a course typically includes only one or few discussion forums, a course developed on the *SSW4LL* format can include several discussion forum activities as LOs that encourage learners to use the discussion forum.
7. *Self-Assessment Tests* include several close-ended questions about the content of a week/module. These questions allow learners to check their acquired knowledge and how well they know the content of the section already through receiving immediate feedback about their answers.

The seven LOs are differently sequenced according to the learning styles features (Table 2.1) and subsequently to the 16 learning profiles resulting from the combination of the eight style categories.

2.4.2 *Informal Learning Environment: Semantic MediaWiki, Diigo and Google+*

In the *SSW4LL* system the elements of the informal learning environment are Semantic MediaWiki, Diigo and Google+,

They have been selected among several alternative solutions on the basis of effectiveness and efficiency in relation to *SSW4LL* target learners' goals. In detail, evaluation has been conducted on the following criteria, attributing a value on a 5-point Likert scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree): social semantic features, effectiveness as tools for characterising adult lifelong learners' PLEs, novel features, possible integration with Moodle 2.0, easy-to-use interface and mobile learning features (Table 2.2).

The categories of tools that needed to be considered for the *SSW4LL* system were aggregators, tools of semantic annotation, social bookmarking and recommended search and social networks. Accordingly, after an initial analysis of a large number of applications, the following nine have been sieved and compared within their categories:

- as aggregators, Evri, Google Reader and Google+;
- as semantic annotation tools, Formal Learning Support System (FLSS) and Semantic MediaWiki;
- as social bookmarking tools, Google Reader and Diigo;
- as recommended search tools, Informal Learning Support System (iFLSS), Binocs and Google+;
- as social network, Google+.

Table 2.2 Comparative evaluation of the tools considered for the informal learning environment

| Criteria/ Tools | Social semantic features | | | | | Characterisation of PLEs | | | | | Novel features | | | | | Integratable with Moodle 2.0 | | | | | Easy-to-use interface | | | | | Mobile learning features | | | | | Value |
|-----------------------|-----------------------------|---|---|---|---|-----------------------------|---|---|---|---|-------------------|---|---|---|---|---------------------------------|---|---|---|---|--------------------------|---|---|---|---|-----------------------------|---|---|---|---|-------|
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | |
| Evri | | | | x | | | | | x | | | | | | x | | | | | | | | | | | | | | | x | 26 |
| FLSS | | | x | | | | | | x | | | | | | x | | | | | | | x | | | | | x | | | | 14 |
| iFLSS | | | | | x | | | | x | | | | | x | x | | | | | | | x | | | | | | | | | 18 |
| Binoos | | | | | x | | | | x | | | | | x | x | | | | | | | x | | | | | | x | | | 21 |
| Google Docs | | x | | | | | | | x | | | | | | | | | | | | | | | | | x | | | | | 25 |
| Google Reader | | | x | | | | | | | | | | | | x | | | | | | | | | | x | | | | | | 26 |
| Semantic MediaWiki | | | | x | | | | | x | | | | | | x | | | x | | | | | | | | | x | | | | 20 |
| Dugo | | | | x | | | | | | x | | | | | x | | | | | x | | | | | | x | | | | x | 29 |
| Google+ | | | | | x | | | | | x | | | | | x | | | | | | | | | | x | | | | | x | 29 |

In the following the characteristics of the elements assessed are presented, and the results of the evaluation and the implications of Semantic MediaWiki, Diigo and Google+ within the *SSW4LL* format are discussed.

Evri¹² is a free aggregator that automatically and constantly indexes millions of topic-specific streams from thousands of different sources to filter through the noise of the Web and deliver customised news. Evri’s topic-based approach to news aggregation is a divergence from the older source-based paradigm. Its core technology platform relies on natural language processing and semantic search to deliver channels of aggregated content on millions of topics. It reconciles content against semi-structured and trend databases to determine result ranking.

The FLSS (Formal Learning Support System)¹³ offers access to learning materials via semantic search techniques. A simple text search returns documents with a varying degree of relevance, by using different wordings of a concept and exploiting implicit semantic relations in the text. The system data include a domain ontology to provide a formal conceptualisation of a domain and semantically annotated LOs. The services provide search, edit and visualisation facilities to help the user access and modify the information; the user can also leave comments and remarks.

Nevertheless, validation reports emphasise that some requirements still lack for the smooth adoption of FLSS, among which exhaustive guidelines and use cases are crucial.

The iFLSS (Informal Learning Support System) consists of a range of services that support knowledge retrieval from Delicious, YouTube, Bibsonomy and Slideshare through a domain ontology enhanced with folksonomy and by recommending material on the basis of the content, tags and users belonging to the relevant social network (Monachesi & Markus, 2010; Monachesi, Markus, Westerhout, Osenova, & Simov, 2011). The widget-based visualisation of the system has a strong focus towards using an expert validated ontology for providing a structured overview of the domain, while social media services allow for personalisation of content recommendation (Posea & Trausan-Matu, 2010). Communication is facilitated

¹²<http://www.evri.com>.

¹³See Sect. 1.3.5 for an in-depth analysis of the LTfLL project and of FLSS and iFLSS.

through the use of social networks, and new communities of learners can be established through the recommendations provided by the system. However, since validation was aimed at an academic institution with a fixed curriculum, while the software was designed for a self-directed LLL context, an additional validation activity should be conducted on this target. Besides, a less elaborate method for setting up the system and an installation guide needs to be provided (Westerhout, Monachesi, Markus, & Posea, 2010).

Binocs¹⁴ is a social search widget that searches over multiple databases (e.g. Youtube, Slideshare, etc.). It employs a federated search engine that aggregates heterogeneous resources and forwards them to a recommender system. Recommended resources ranging from wiki pages, videos, to presentations can be saved, shared, assessed and re-purposed according to each user's interest. To rank resources, the recommender system considers the following user's actions (1) selecting a resource from a search result, (2) liking or disliking a search result (using a thumbs up and down feature) and (3) previewing a search result. The recommender system relies on an algorithm influenced by Google's original PageRank algorithm (Page, Brin, Motwani, & Winograd, 1999) and based on the 3A interaction model (El Helou, Salzmann, & Gillet, 2010). In the absence of previous user interaction with a resource, ranking is still possible based on the resource relevance to the search query.

A preliminary evaluation of the widget's usability and recommendation usefulness helped to improve the user interface, and showed that, since users prefer Google results due to their diversity, more repositories should be added to the federated search engine. On the other hand, pilot users agreed on the usefulness of the collaborative recommendations on top of the search results (Modritscher et al., 2011).

Google Docs¹⁵ is a free cloud computing document-sharing services. In comparison with other similar tools, its added value stands in its enhanced sharing features and accessibility. This Google's "software as a service" office suite allows to create, edit and share documents in real time among multiple users. Documents, spreadsheets, presentations can be created, imported through the Web interface or sent via email. Documents can be saved to a user's local computer in a variety of formats (ODF, HTML, PDF, RTF, Text, Microsoft Office), are automatically saved to Google's servers to prevent data loss and a revision history is automatically kept. Moreover, documents can be tagged and archived for organisational purposes. Users cannot be notified of changes, not even in real-time work, but users can see where in the document a particular editor is currently writing by an editor-specific colour/cursor. Also, the revision history allows users to see the changes made to a document, distinguished by editor/colour. Besides, the application can notify users when a comment or discussion is made or replied to, facilitating collaboration.

¹⁴Binocs is developed in the context of the ROLE project. See Sect. 1.3.5.

¹⁵See an overview of Google Docs.

Google Reader¹⁶ is a Web-based aggregator, capable of reading Atom and RSS feeds online or offline. As of 2010 its features include a front page that shows new items at a glance, import and export subscription lists as an OPML file, keyboard shortcuts for main functions, choice between *list view* or *expanded view* for item viewing, automatic marking of items as read as they are scrolled past and search in all feeds, across all updates from subscriptions. Part of the visual redesign of all Google products in 2011, a new Google Reader interface was available on October 31, 2011. Beside the sweeping visual changes, former social features (“share” and “like” buttons) have been removed and replaced by Google+’s “+1” button and the “share on Google+” box.

Semantic MediaWiki¹⁷ is one of the most popular semantically enhanced collaborative knowledge management systems, mostly because it aims to make semantic technologies accessible to non-expert users. Semantic MediaWiki is an extension to MediaWiki that enables users to semantically annotate wiki pages, based on which the wiki contents can be browsed, searched and reused in novel ways (Krötzsch, Vrandečić, Völkel, Haller, Studer, et al., 2007).

RDF and OWL are used in the background to formally annotate information in wiki pages. Every page corresponds to an ontological element (including classes and properties) that might be further described by annotations on that same page, to allow users to understand where the information originated from and make maintenance easy.

Different namespaces are used to distinguish the semantic function of wiki pages. The namespaces are defined through the wiki configuration and cannot be defined by users. They can be individual elements (most of the pages, describing elements of the domain of interest), categories (to classify individual elements and to create subcategories), properties (relationships between two pages or a page and a data value) and types (to distinguish different kinds of properties).

Most annotations can easily be exported in terms of OWL DL: normal pages correspond to abstract individuals, properties correspond to OWL properties, categories correspond to OWL classes and property values can be abstract individuals or typed literals. Thus, most annotations are directly mapped to simple OWL statements, similar to RDF triples (Bratsas, Kapsas, Konstantinidis, Koutsouridis, & Bamidis, 2009).

Templates and forms allow to restrict the user to a predefined set of annotations. The advantage of this mixture of guided input and open annotations is that the structure of the data can evolve dynamically.

Although the usefulness of Semantic MediaWiki features attracts many potential users, issues about Semantic MediaWiki’s resource requirements, stability and scalability are raised (Herzig & Ell, 2010).

Diigo¹⁸ is two services in one: it is a research and collaborative research tool on the one hand and a knowledge-sharing community and social content site on the other. It provides a browser add-on that improves research productivity. Beyond bookmarking, Diigo allows to highlight portions of Web pages that are of particular

¹⁶See <http://googlereader.blogspot.com/>.

¹⁷http://semantic-mediawiki.org/wiki/Semantic_MediaWiki.

¹⁸<http://www.diigo.com>. Diigo is an acronym from “Digest of Internet Information, Groups and Other stuff”.

interest to the user, and to attach sticky notes to specific parts of Web pages. Further, unlike most similar tools, Diigo highlights and sticky notes are persistent. Moreover, all the information are saved on Diigo servers, creating a user's personal digest of the Web that he/she can easily search, access, sort and share from any PC or even iPhone. Groups can be created.

Every Diigo user's tags and annotations feed a collectively enriched repository of content. Users can subscribe to any bookmark under any set of tags, and the system provides recommended news and resources personalised to their interests. Besides, while the user is on a Web page, the Diigo sidebar shows who else has bookmarked this page or this site, and what other similar pages and sites they have bookmarked, providing a social browsing experience and an efficient way to find related content and people. Subsequently, a user can connect with them in multiple ways: by inviting them to add him/her as a friend, sending them messages, inviting them to a group or simply adding them to her/his watch-list.

Google+ is a brand-new sharing network that lets users share different things with different people. Google+ main features are:

- *circles* that enable a user to organise contacts into groups for sharing across various Google products and services. Although other users can view the list of people in a user's collection of circles, they cannot view the names of those circles. Organisation is done through a drag-and-drop interface;
- *sparks* is a front-end to Google Search, enabling users to identify topics they might be interested in sharing with others. *Featured interests* Sparks are also available, based on topics others globally are finding interesting;
- *hangouts* are group video chat (with a maximum of 10 people participating in a single *Hangout*). However, anyone on the Web could potentially join in if they happen to possess the unique URL of the Hangout;
- *huddle* is a group messaging feature available within the Google+ mobile app. Rather than sending text messages to each person in a circle, the user sends *Huddle messages* to the group;
- the *+1* button lets users publicly recommend pages across the Web, share with the right circles on Google+, help improve Google Search as well, since Google shows which pages a user's social connections have +1'd right beneath search results and ads.

A core element of Google+ is its privacy features, which have been integrated deeply into the product. Google+ gives users extensive control over these features.

Table 2.2 shows the comparison between the nine applications against the six parameters relevant to the effectiveness and efficiency of the SSW4LL format. Discrete and total values highlight that Semantic MediaWiki, Diigo and Google+ are the best solutions to be integrated in the format. Within the different categories considered, values are:

- as aggregators, Evri=26, Google Reader=26 and Google+=29;
- as semantic annotation tools, FLSS=14 and Semantic MediaWiki=20;
- as social bookmarking tools, Google Reader=26 and Diigo=29;
- as recommended search tools, iFLSS=18, Binocs=21 and Google+=29;

- as social network, Google+ is the only solution considered in this final screening because it had already appeared as the most complete and innovative.

Semantic MediaWiki results slightly critical in its interface and in relation to mobile learning; however, it still is more flexible, collaborative, tested and documented than FLSS.

Google+, beyond being chosen for its characteristics as a social network, offers all together the features that Evri, iFLSS and Binocs provide. Further, iFLSS and Binocs cannot be integrated with Moodle 2.0. Besides, the validation of iFLSS is incomplete, the method of its setting is elaborate and no installation guide is provided. Finally, the validation test of Binocs showed that pilot users preferred Google results due to their diversity.

Diigo is decisively superior to Google Reader in relation to social semantic features, easy-to-use interface and integration with Moodle 2.0.

As a whole, the influence of the informal learning components of the *SSW4LL* system is strong. As a matter of fact, since a flexible and personalised learning environment requires that content can be accessed, evaluated, organised and reused with ease by the students, social software and Semantic Web technology play an important role in such learning environments. Where social software gives users freedom to choose their own processes and supports the collaboration of people *anytime, anywhere*, Semantic Web technology gives the possibility to structure information for easy retrieval, reuse and exchange between different systems and tools (Bratsas et al., 2009).

2.5 Organisation

2.5.1 *Technical Competences Required*

The implementation and management of the *SSW4LL* format requires various kinds and degrees of skills and knowledge. The professional profiles involved are a learning technologist, an ICT technician and a (or more) teacher-facilitator. The learning technologist's and the ICT technician's tasks could be accomplished by one professional with competences for both profiles.

The learning technologist has extensive knowledge of the use of Moodle, Semantic MediaWiki, Diigo and Google+, and of all the other technologies that could support learning and teaching within the *SSW4LL* format. He/she deals with the implementation, updating and troubleshooting of the different technological components of the format.

The ICT technician has knowledge of a range of ICT hardware and applications commonly used, and has good problem-solving and organisational skills. He/she provides the facilitator and learners with technical support, guidance and maintenance in order to use all software/hardware correctly during the learning path. He/she conveys technical tasks in simple ways.

The teacher-facilitator is familiar with the design, implementation and management of Moodle 2.0 courses, including the settings of conditional activities.

Students have basic digital competences and use of Web 2.0 tools (forums, wikis, social bookmarking and social networks).

2.5.2 Devices

The implementation of the *SSW4LL* format in a distributed learning environment requires an Internet connection and one of the following sets of equipment, according to the students' location:

- a workstation, a webcam and a headphone set if the students are in a fixed location;
- smartphones, portable game consoles or tablets if the students are in a mobile learning environment;
- laptops, smartphones, ultra-mobile PCs or tablets together with the use of sensor network nodes, contact-less smart cards, RFID (Radio Frequency Identification) and QR (Quick Response) codes, if the students are in a ubiquitous learning environment (as an extension of the *SSW4LL* format that would consider the organisation of the learning environment in both real spaces/elements—physical location, participants and paper-based learning material—and virtual spaces/elements—HTML pages, interactive learning materials and Web-based tools).

2.5.3 Recommendations for an Optimal Implementation of the Format

The format *SSW4LL* is very flexible for both the teacher–facilitator and the learners. Anyhow, crucial factors for the success of the experience are (1) thorough organisation and management of the necessary hardware and software; (2) an adequate familiarisation of the students with the learning environment (technology, tools and learning approach); (3) a light e-moderation by the facilitator, in order to provide a modulation of self-regulated and shared learning on the basis of the students' silent and/or expressed requests, with the aim of supporting participants' high motivation.

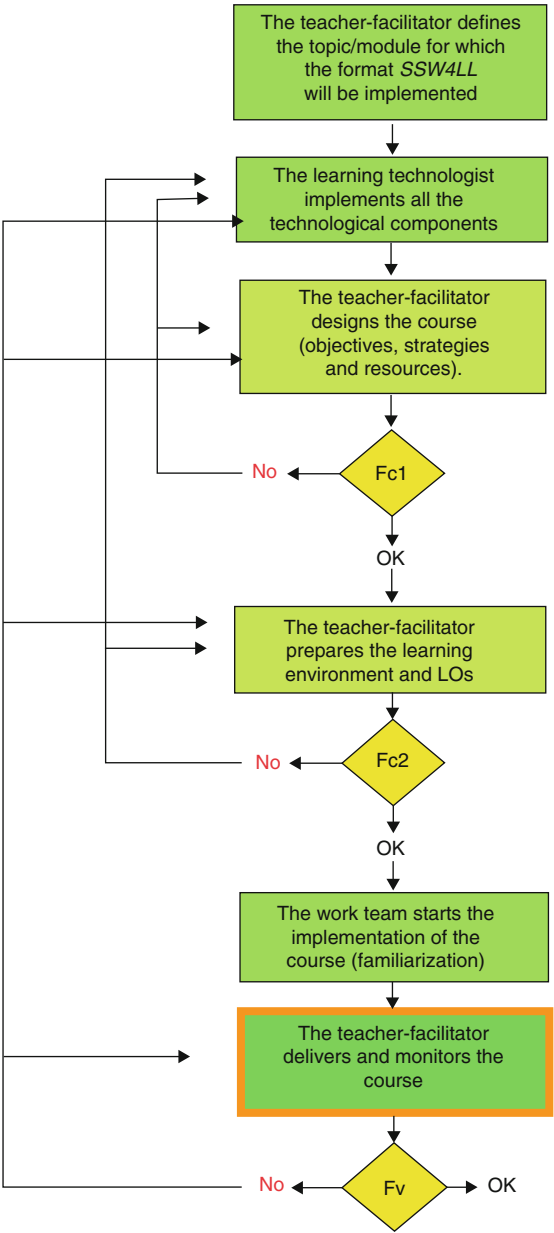
2.5.4 Workflow and Procedures

The process of feasibility check and of implementation of the format is made up of two phases, as described in the following.

1. Phase I: Feasibility check (Fc)

The check of the feasibility of the planned learning experience is carried out by the teacher–facilitator with the learning technologist and the ICT technician through a double check (Fc1 and Fc2) to verify the correct functioning of all the necessary hardware, software and networks.

Fig. 2.4 Flow chart of the implementation process of the SSW4LL format



2. Phase 2: Format validation (Fv)

The validation of the format as a whole is carried out by the ICT technician on the hardware, software and networks used, on the basis of a checklist, and by the teacher–facilitator, on the basis of evaluation and assessment (Fig. 2.4).

2.5.5 Use Case Scenario

John is a senior university lecturer in the history of music. He is a strongly motivated self-directed learner, as well. Anyhow, work overload does not leave him much time to update his PLE as he would like to. Time constraints and information overload are difficult issues for John, who is considering to look for a flexible course to meet his needs as a lifelong learner. Since he has thought of dedicating some time to deepen his knowledge of jazz for a bit, he decides to enrol in a refresher course on this topic that his university is offering entirely online, in a learner-centred approach, over 2 weeks. He is not new to technology-enhanced learning, but this is the first time he uses some of the tools provided within the course. For this reason, as soon as he receives his logins to Moodle and SMW, and the invitation to join in the Diigo course group and Google+ from the teacher-facilitator, he creates his accounts in these two. He is familiar with social bookmarking and has already used Diigo search before, but he is not a keen user of social networks. He already knows he is not going to use Google+ that much during the course. Anyhow, he decides to enter Moodle to have a look at the video tutorials that the facilitator has suggested for these first two warm-up days of technological familiarisation; he is also curious to meet the other participants and happy to introduce himself in the participants' forum. When he logs in Moodle, he finds a welcoming post by the facilitator and his reminder to complete the entry survey to express expectations and personal background. John carries out the survey and suddenly he visualises a video presentation of the course and a list of tutorials, user's manuals and sandboxes. John is free to choose among them and spends some time in Semantic MediaWiki sandbox; semantic annotation appears decisively useful to his goals in terms of knowledge construction and management, but he needs more time to practice.

At the end of the first two days, John has met 10 course peers in the forum (introductions), in Diigo and in Google+. He has shared a couple of resources in Diigo (using Diigo highlighter, sticky notes and tags) and has created the course circle in his Google+ account. He realises that, through his contacts in these social tools, he is already able to easily get to new resources and users related to the history of jazz.

At the beginning of the third day, the facilitator invites participants to find out more in Moodle: learning modules are ready to be accessed. What is new to John is that learning is personalised: John logs in Moodle and can visualise the quiz *How do you prefer to learn?*; he completes it, he obtains a feedback about his learning style, he confirms it in a "choice" tool for the corresponding most suitable learning sequence and the system starts his sequence of LOs. John is able to visualise the various LOs as he proceeds, and at the end he can move among them as he prefers. This allows John to both take advantage of a personalised scaffolded learning path and to decide autonomously what to do and how much time and effort to spend. He is also aware of his prior knowledge on the topic because he has answered a true/false quiz. He is free to spend as much time as he needs on each learning resource, and he can self-check his knowledge and skills as many times as he feels like through the self-assessment test. Besides, he comments in the forum, he participates in a video hangout in Google+, he collects and annotates considerations in Semantic

MediaWiki and he follows what is going on in the Diigo course group by the Diigo widgets in Moodle. At the end of the first week, John realises he has learnt more about jazz, but, above all, he has had the chance to learn to use new tools that can support him in managing his PLE.

2.6 SWOT Analysis

The following matrix highlights strengths, weaknesses, opportunities and threats of the *SSW4LL* format (Table 2.3).

2.7 Summary

This chapter has started the development of the characterisation of a PLE as a LLL tool by detailing the *SSW4LL* format. After an overview about the aims, possible scenarios and elements of the format, a motivated choice of adult lifelong learners’ needs that *SSW4LL* aims to meet has been developed. Subsequently, the learning paradigm and strategies that underpin the *SSW4LL* format have been illustrated. Then, the *SSW4LL* system, the technological architecture, has been presented as a whole made up of components of formal and informal learning environments. The formal learning environment has been devised by Moodle 2.0; a description and an evaluation of Moodle 2.0 features have been provided, with a focus on the potential of its conditional activities as a suitable mechanism of learning adaptation. Concurrently, this part has identified the benefits of the FSLSM, which was selected as the most suitable learning style model for the use in LMSs. The elements of the informal learning environment, Semantic MediaWiki, Diigo and Google+, have been presented, and their implications within the *SSW4LL* format have been discussed. The next section of the chapter has dealt with the organisation of the format: the resources needed, a user case scenario and a flow chart of the steps of the format implementation have been outlined. Finally, a SWOT analysis has provided evaluation elements for the format.

As a whole, this chapter has allowed to achieve the following results. The *SSW4LL* format offers an adaptive, modular, flexible and integrated architecture,

Table 2.3 SWOT analysis of the *SSW4LL* format

| | | |
|----------|--|--|
| Internal | Strengths | Weaknesses |
| | <ul style="list-style-type: none">• Scaffolded self-regulated learning.• Personalised and flexible learning.• Novel tools for the characterisation of adult lifelong learners’ PLEs. | <ul style="list-style-type: none">• Possible technological issues can cause demotivation. |
| External | Opportunities | Threats |
| | <ul style="list-style-type: none">• Growing availability of open software and learning materials.• Increasing individuals’ awareness of the importance of a LLL vision. | <ul style="list-style-type: none">• If the format is applied by a teacher-centred approach, its aims and flexibility are affected.• Insufficient Internet connection. |

compatible with future Moodle releases and easy to use for teachers-facilitators. The influence of the informal learning components of the *SSW4LL* system is strong: where social software gives users freedom to choose their own processes and supports the collaboration of adult lifelong learners *anytime, anywhere*, Semantic Web technology gives the possibility to structure information for easy retrieval, reuse and exchange between different systems and tools.

The format is conceived to empower adult lifelong learners by facilitating the acquisition of some of the skills necessary for the twenty-first century.

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a Lifelong Learning Tool

Leone, S.

2013, XIV, 88 p. 18 illus., 17 illus. in color., Softcover

ISBN: 978-1-4614-6273-6