KLeOS: A personal, mobile, Knowledge and Learning Organisation System

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Abstract

The design of a personal, mobile Knowledge and Learning Organisation System (KLeOS) is described. Studies of adult learning practice showed [1] that learning activity is mobile between locations, time slots, and topic areas. Moreover, learning follows a hierarchical organisation at three operational levels: learning activities are discrete acts, which are grouped to form learning episodes, which in turn are grouped to form learning projects.

KLeOS reflects this hierarchical structure and allows the user to organise and manage their learning experiences and resources as a visual timeline. In addition, it incorporates a knowledge map, which is updated as the user progresses through learning experiences. The interface of the organiser is based on the idea of timelines and employs project lines and activity lines to represent the user's learning over a lifetime. The organiser forms a bridge between the timeline and the knowledge map by tagging the nodes of knowledge with the context of the learning episode(s) within which that knowledge was acquired. The architecture of KLeOS allows it to be used on a number of different platforms, thus ensuring mobility.

1. Introduction

In seeking to design a system that supports a person's everyday learning over a lifetime, a descriptive Framework of Lifelong Learning (FoLL) was produced. The framework originated in a theory-informed phenomenological study of learning [1]. This study required learners to keep diaries of their daily learning and at the end to participate in a structured interview which explored issues arising from the diary entries.

The study indicated three ways in which learning can be considered "mobile": learning is mobile in terms of space, i.e. it happens at the workplace, at home, and at places of leisure; it is mobile between different areas of life, i.e. it may relate to work demands, self-improvement, or leisure; and it is mobile with respect to time, i.e. it happens at different times during the day, on working days or on weekends.

The study also analysed the activities that people reported to carry out during learning. The participants were asked to report their learning experiences, without being given a strict definition of a learning experience. In some cases, a diary entry reported the performance of a single activity (e.g. reading a book). In other cases, however, a diary entry described a learning experience (such as writing a report for a university course), which involved the performance of a number of distinct activities (e.g. reading, searching the internet, and taking notes).

The fact that people reported these as a single learning experience rather than as distinct experiences demonstrates that people differentiate between learning *episodes* and *activities:* distinct learning acts are grouped together by thematic, temporal and/or spatial proximity to form learning episodes. In some cases, people described episodes as forming part of a greater learning *project*. To group episodes into projects, people use purposes and outcomes: episodes that contribute to the achievement of a particular aim are likely to be grouped together under a single project. A number of learning projects may be pursued during the same period. Learning episodes may contribute towards more than one learning project.

The FoLL led further to the definition of a set of general requirements for lifelong learning support. The requirements pointed to the need for a tool that provides facilities for the management of learning and of learning materials and resources. Furthermore, mobility and flexibility with respect to time, place and topic were identified as important attributes of an enduring learning support system. Based on these requirements a prototype system, KLeOS (Knowledge and Learning Organisation System), was designed.

The FoLL is fully described in [1]. Section 2 of this paper outlines the general requirements for lifelong learning support as they were identified based on the framework. Section 3 presents KLeOS and section 4 concludes with a summary of the methodology followed and the plans for future research.

2. General requirements for lifelong learning support

Based on FoLL a set of general requirements for lifelong learning support was produced. Of these, the requirements that pertain to supporting the organisation of learning are:

1. Support the learner in performing learning activities.
   - 1.1 Assist the learner to seek support for context-dependent activities (for example, using a specific piece of software, cooking).
   - 1.2 Support the following context-independent activities: note-taking, discussion and communication, searching for information,

reading, writing, problem solving and recovery, and memorisation and remembering of information about people, events, concepts, places, etc.

2. Support the learner's learning episodes
   2.1 Monitor the context of a learning episode and aid the user to perform all the associated activities and to interpret and use the outcomes.
3. Support the user in pursuing learning projects
   3.1 Support the planning of projects
   3.2 Assist in identifying, locating and accessing relevant resources
   3.3 Assist in progress assessment and re-planning
4. Aid the user in synthesising serendipitous learning, planning deliberate learning, and managing semi-structured learning
   4.1 Aid the organisation of learning activities into episodes or the planning of activities for an episode.
   4.2 Aid the association of episodes with learning projects or the planning of episodes to enable the completion of projects.

With respect to mobility of learning, the requirements for supporting mobility are:

1. The system should be easily transferable between places: the system should be either implemented on a device that is easy to carry and use around, or it should be designed so as to run on a single computer system and be accessed remotely.
2. The system should be available and functional anytime during any day of the week, and endure over long periods of time.
3. The system should provide a smooth transition between learning different topic areas and support the user to construct meaningful, integrated knowledge.

3. KLeOS's prototype

The prototype for KLeOS was designed based on the requirements outlined in section 2. The design reflects the hierarchical organisation of the learning practice that we described. The prototype demonstrates functionality in three different levels, allowing the user to (a) manage their learning projects; (b) monitor the learning episodes they complete and associate them with projects where applicable; and (c) perform learning activities whilst within an episode.

The prototype also features a knowledge map, which reflects the knowledge that the user has acquired over time. The knowledge map is not disconnected from the organiser. Rather, it bridges between the two components so that the user can update the knowledge map whenever a new piece of knowledge is acquired during learning, or alternatively the user can start from a map entry and trace back the learning episodes that led to this knowledge.

In effect, this combination allows for monitoring both semantic and episodic memories. Episodic memory is involved in the recording and subsequent retrieval of memories of personal happenings and doings, whereas semantic memory relates to knowledge of the world that is independent of a person's identity and past [2]. Episodic memory records have been used in the past for information retrieval [3, 4]. The working hypothesis for KLeOS is that an interlinked record of semantic and episodic learning memories will be a better aid for knowledge retrieval than a semantic-only or episodic-only record.

The design and a partial implementation of the system have been completed. The current implementation, in Java, consists of three parts. The first part implements a basic concept map that allows the user to create nodes of knowledge, information, facts, etc., and define associations between them. The second part implements a zoomable timeline interface for managing learning projects and monitoring relevant learning episodes. The third part is used in supporting the performance of learning activities whilst within an episode. Work remains to be done on the interlinking between the three parts.

3.1 System Interface

The design of the system's interface started with producing a series of screen designs. The interface is based on the timelines metaphor [5, 6]. Timelines are graphical representations (lines) that depict a period of time during which a specific event was occurring. As memories of learning events fall in the category of episodic memory, the person organises them chronologically [2] and thus it is reasonable to assume that a representation based on timelines will be meaningful to the user.

For KLeOS, learning projects are represented by such lines. The user can zoom in and out in time to gain daily, weekly, monthly, yearly, and decade views. The colour of the project line shows the type of the project (work-related, leisure-related, self-improvement, or other). The thickness of the project line indicates the project's importance to the learner (low, normal, or high) (see fig. 1).

Episodes that are associated with a project appear as marks on the project line at the corresponding point in time. This presupposes that learning episodes exhibit time continuity, which is in accordance with learners' perceptions [1]. If a learning episode takes place but is not as yet associated with a learning project, a stand-alone mark will appear above the corresponding point in time (see disparate marks above the timeline bar in fig. 1). If the user decides later that this episode relates to an existing project – or even decides to start a new project based on the episode – they can drag and drop the episode onto the project line.

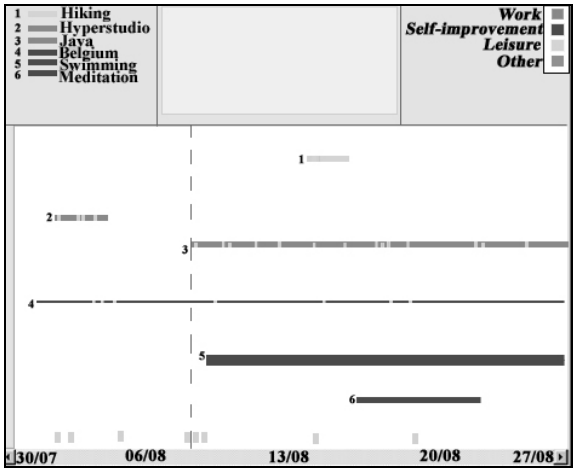

Figure 1. KLeOS's project lines interface

If a learner decides to revisit a past learning episode the screen changes (see fig. 2). At the bottom part of the screen appears information about the episode's context. At the middle of the screen the metaphor of timelines is used again, this time to represent the learning activities that the user performed during that episode. Here the time axis has a start and an end, which are the starting and ending times of the episode, unlike the project lines space where time can go indefinitely into the future and starts when the first episode was recorded.

It was decided that only the most common learning activities would be supported by the system. Thus, only reading, writing, conversing, and searching are being supported. Each of these activities is assigned a horizontal level for its respective timeline, with segments shown for the time periods when the user was performing that activity. To review the relevant materials, objects and records of an activity, the user has to select it: the relevant document will then appear at the top part of the screen (a text document if it was a reading, a transcript or an audio recording if it was a conversation, a list of links if it was a web search).

The recording of learning activities is carried out automatically where possible. For example, when the system detects that a web search is being done, or that the user is reading a text document, the relevant activity will be recorded. Ideally, the context of the activity will be recorded automatically as well.

While revisiting past learning episodes or undertaking new ones, the user learns concepts and facts, and forms relations between them, as well as relations to other pieces of knowledge that had been acquired in the past. These are recorded in a personal knowledge map [7]. When the user encounters a new concept, they have the option to add it to the knowledge map. The system may "know" the topic of the current learning episode, and thus be able to retrieve the relevant portion of the map. Or the user may select to start a new portion in the map, if a new topic is being learnt. Links between different portions of the map can allow for knowledge interconnections.

When added to the map, a knowledge node is tagged with information about the context in which the learning took place. While navigating the knowledge map, the user may encounter concepts that were learned during different learning episodes. A popup menu box informs the user of the learning episode context(s) where the specific knowledge node was encountered (see fig. 3). The user may then select to revisit that context.

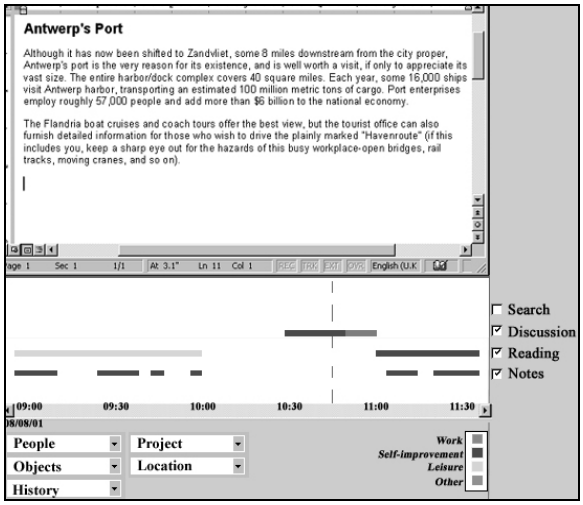

Figure 2. Revisiting a past episode in KLeOS

The system thus provides two ways for retrieving electronic learning objects and/or the knowledge learnt through them: (a) by exploring project lines to locate relevant learning episodes and activities (i.e. based on the user's episodic memory), and (b) by navigating through a web of relevant concepts (i.e. based on the user's semantic memory).

To illustrate the utility of the system, let us think of a learner who explores a topic, for example management theories, in the context of a university course. During one learning episode, the learner is skim-reading an e-book, from which she extracts the key concepts and makes short notes of them, and then uses them to perform an internet search to locate and access further relevant information, notes of which she adds to her notebook. For the system, these two activities of reading the book and searching the internet would have been recorded on two activity lines, in fig. 2. The whole episode would appear as a mark on the appropriate date of a project line in fig. 1. The initial key concepts would have been nodes of the concept map. As additional knowledge was learned about the topic, further nodes and relationship links would have been created on the concept map. Each node of the map would be automatically tagged with information about the activity where that concept had been learned. If the learner later, while revising her notes, decided that she wanted to find some more details about one concept, or verify the source of her knowledge, she could revisit

the relevant activity where she learned it, and access the original document.

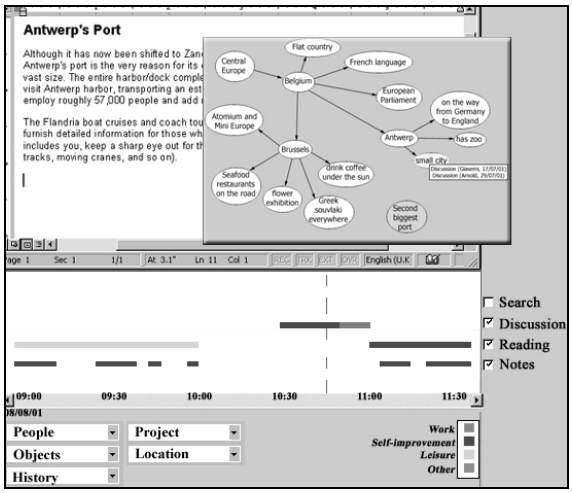

Figure 3. Navigating the concept map whilst in a learning episode

3.2 System mobility

KLEOS is now being implemented as a Java application. The conceived architecture and functionality of the system allow for the mobility of learning to be accommodated. The information about learning projects, episodes and activities will be stored in a database. The choice of Java ensures that the application will be easily transferable between different platforms. The Java platform is now available for the Compaq iPaq® and thus a version of the interface for small devices could be implemented in the future. However, the limitations of small devices and particularly the small screen could introduce problems, particularly in showing the relations between differing items of knowledge and context. The database could be held on the user's main PC or notebook locally and accessed from any other client device remotely. With the rapid improvements of telecommunications networks, this configuration will provide all the flexibility needed to learn anywhere, anytime.

KLeOS's intrinsic functionality allows the user rapidly to transfer from one learning project to another, by navigating time and clicking on the appropriate project lines and episode marks, or by navigating the concept map.

4. Conclusions and future work

We devised a Framework of Lifelong Learning, informing it with theories of learning. When looking to support lifelong learning, the focus should not be only on work-related learning: learning that relates to self-improvement, leisure, or to enduring everyday life challenges, should also be supported. Learning should be enabled at any location where it might be performed, irrespective of the time of the day or the day of the week when it happens.

Learning can be analysed at three levels of granularity: at the lowest level are the distinct learning activities that the learner performs; at the middle level there are collections of learning activities that have thematic, spatial and/or temporal proximity, which form learning episodes; at the highest level there are sets of learning episodes that are related by objective, which form learning projects.

The framework of lifelong learning was translated into a set of general requirements for lifelong learning support, which pointed to the need for supporting learners to manage and organise their learning experiences and resources and their knowledge, and to learn anything, anywhere, anytime.

Based on the requirements, a prototype knowledge and learning organiser system was designed. KLeOS reflects the hierarchical organisation of learning and allows the user to organise and manage their learning experiences and resources. In addition, it incorporates a knowledge map, which is updated as the user progresses through their learning experiences. The nodes of knowledge with the context of the learning episode(s) within which that knowledge was acquired. The architecture of KLeOS allows it to be used on a number of different platforms, thus ensuring mobility.

The prototype interface needs to be refined. Decisions that are still to be made include utilizing the representation of learning episodes that relate to more than one project; the interfacing with tools for learning activities other than those supported by the system; and the time span during which a knowledge node is useful. Another interesting issue to be explored is to what extent the revisiting of a past learning episode constitutes a new learning experience in itself, whether the original revisited episode should be modified, and whether a versions record of learning episodes should be kept.

Finally, once the system is fully implemented, a system evaluation will need to be performed in order to decide both the usefulness of the concept and the system's usability.

5. References

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