

Comparative Study of Personal Learning Environment's Construction Ways and Technologies

Lizhen He
South China Normal University, P.R.China
876625176@qq.com

Yunxiang Zheng*
South China Normal University, P.R.China
zsuzd@163.com

Abstract: Personal Learning Environment (PLE) represents a new trend in learning environment and might be useful or indeed central to learning in the future. Several researches have been made since it was proposed in 2004. Now it is widely used in personalized learning of all levels, from primary school learning to university learning, and even lifelong learning. This paper aims to clarify three different ways of constructing PLE and the associated technologies, such as Blog, ELGG, iGoogle, etc. By elucidating its definition, characteristics and making comparative analysis, the paper summaries their respective advantages and application scope. So as to give users some suggestion on customizing learning environment according to their personal needs.

Keywords: *Personal Learning Environment, construction way, PLE technology, comparative analysis*

* Corresponding author

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INTRODUCTION

With the rapid development of Information Communication Technology (ICT), especially web 2.0 technology that is characterized by highly decentralized, personalized and open, teaching and learning in the information age has greatly changed. The instructional design of a course or a lesson is paying more and more attention to learner's involvement, in order to improve learner's personal experience and get better learning effect. In this backdrop, trying to provide every learner with ICT environment to support personalized learning and lifelong learning, has become one of the policies of Chinese ten-year development plan for education informatization (2011-2020). Learning on the basis of Personal Learning Environment (PLE) is a new-born learning pattern in the trend of technical innovation and learning concept change, aiming to provide learners with personalized learning services and open learning space, and ultimately enhance the efficiency and effect of knowledge construction.

PLE is an evolving term, one without a single, widely accepted definition. According to Wikipedia, the term was first mentioned on a session at a JISC/CETIS conference in the year 2004 (Wikipedia 2008). Van Harmelen defined PLE as system that helped learners take control of and manage their own learning (van Harmelen 2006). Lubensky defined it as a facility for an individual to access, aggregate, configure and manipulate digital artifacts of their ongoing learning experience (Lubensky 2006). FitzGerald considered it as a collection of free, distributed, web-based tools, usually centered around a blog, linked together and aggregating content using RSS (Really Simple Syndication) feeds and simple HTML scripts (FitzGerald 2006). And EDUCAUSE (a nonprofit association whose mission is to advance higher education through the use of information technology in America) proposed that PLE described the tools, communities, and services that constituted the individual educational platforms learners used to direct their own learning and pursue educational goals (EDUCAUSE 2009).

Inspired by the success of "sticky" new technologies in ubiquitous computing and social software (Attwell 2007), PLE is characterized by highly personalized, service oriented, and free & open in our opinion as follows.

(1) Highly personalized. Just as the name implies, PLE is learner centered and serves as study plots or learning space. Learners can take control of their learning content, target, path or schedule independently by means of subscription, sharing, communication, creation and so on.

(2) Service-oriented. PLE advocates the concept of personal service to meet personal needs, including storage service, communication service, user profile service, etc., which changes learner's role from information consumer to prosumer (Schaffert & Hilzensauer 2008).

(3) Free & open. PLE not only provides learners with freeform use of a set of lightweight services and tools to shape their own personal learning space, but also gives learners a useful way to contact with others. So that learners are able to get together by forming and joining communities and communicate with each other easily, breaking time and space boundary, which contributes to get a free and open surroundings and make learning become easier.

PLE offers considerable potential for knowledge development and sharing, so that it is useful to everyone who wishes to organize their own learning. To be specific, PLE does not only provide personal spaces, which belong to and are controlled by the user, but also requires a social context by offering means to connect with other personal spaces for effective knowledge sharing and collaborative knowledge creation. PLE can also be used in a way that promotes self-regulation and autonomous learning in ways that are transferable between formal and informal learning contexts (Dabbagh & Kitsantas 2012).

WAYS OF BUILDING PLE

Nowadays several research projects are in progress developing and researching PLE (Downes 2009; van Harmelen 2009; Attwell 2009). And researchers have proposed several methods of constructing PLE, for example, Chen advocated starting from Blog, Google services, and ZOHO services (Chen 2010), Ji & Li proposed integrating Virtual Learning Environment (VLE), WIKI, and social aggregators to get a Mashup PLE (Ji & Li 2010), Wang tried building PLE on basis of social network services (Wang 2009), and Attwell introduced a Mashup approach made-up of a collection of loosely coupled tools to build a PLE for workers' knowledge development and maturing (working, learning, reflection and collaboration with others) to give labor market information as part of careers guidance (Attwell 2008), etc.

Technically, PLE can be represented as the integration of a number of Web 2.0 technologies like Blog, Wiki, RSS, Tag, etc. Based on literature overview, we summarize three ways to build PLE effectively as follows.

(1) Building PLE on the basis of social software

PLE enables learners to change from knowledge consumers to prosumers, which cannot be realized

without effective learning, discussion, and sharing with others. Social software applications, also known as social apps, include communication tools and interactive tools often based on the Internet. These tools focus on establishing and maintaining a connection among users, facilitating the mechanics of conversation and talk. Building PLE in this way usually starts from picking up a certain social software application (foundation) then integrates other useful apps or plug-ins on demand. In practice, Blog, Wiki, 360 library and so on are typical foundations. Among them Blog is the most widely used.

(2) Building PLE on the basis of social aggregator

Resorting to social aggregator is another way to build PLE. Typical aggregators include Google, ZOH0, Netvibes, etc., with powerful, diversified Web 2.0 services. For instance, iGoogle provides Google Reader (for online RSS reading), Google Docs (for web-based documents creation, edition, and collaboration in real-time with other learners), Google Calendar (for online schedule management), Gmail and Google Groups (to support discussion groups). Learners can add, remove and rank the plug-ins by themselves according to their individualized requirements.

(3) Building PLE on the basis of VLE

VLE is currently a prevalent education system based on the web that models conventional in-person education by providing equivalent virtual access to classes, class content, homework, assessments, and other external resources. According to our statistical results, Blackboard, WebCT, Moodle and Sakai are popular VLE platforms. By adding some third-party tools and services like software components or widgets (Taraghi, Altmann & Ebner 2011), they are able to provide customized services to support personalized learning better.

COMMONLY-USED TECHNOLOGIES OF PLE

Each of the above three ways has several typical implementation solutions in practice, e.g. when building PLE on the basis of social software, we can choose Blog, 360doc, ELGG and so on as foundation to integrate other apps or plug-ins; while building PLE on the basis of social aggregator, we can choose iGoogle, or Yahoo pipes to fulfill the presentation mashup and content mashup respectively; while in the case of building PLE on VLE, a possible solution is combining eyeOS and Moodle. This section introduces some of them one by one.

360doc is a free website for collection and share of documents. Once registered, users possess their personal digital library, so that they can collect, file and share their resources. The advantage lies in its powerful online reading room, enabling users to make ordinary operations on their articles, papers, posts, blog, and so on, share experience with each other, make friends with peers. Constructing PLE on the basis of 360doc results in an open, convenient platform for learners to read, write and exchange personal experience with others, to file them orderly, to make subscriptions via RSS feeds, to tag them for further use like retrieval and matching, etc.

Blog is a discussion or informational site published on the World Wide Web and consisting of discrete entries ("posts") typically displayed in reverse chronological order. The rise of Twitter and other "microblogging" systems helps integrate multi-author blogs and single-author blogs into societal newstreams. Blog is regarded as personal "reader's digests" in cyber era, making learners record and share their own viewpoints, experience and ideas freely. From this point of view, it is considered as a small personal knowledge management system. Online sharing helps to form a dynamic, effective and open community based on a certain topic, where learners read each other's tags, weblogs, or other shared documents. Moreover, it helps to make friends, give comments, start a discussion or even burst new ideas through collaborative brainstorming. Constructing PLE associated with a certain course on the basis of Blog easily covers learning modules such as virtual collaborative groups, searching by Google, talking by IM (Instant Messenger), self reflection, resource sharing, etc. So that learners can get entry into their group member's PLE to exchange ideas or discuss, and teachers can get information about students' current status, learning progress and their thoughts according to students' blogs or reflections. In addition, teachers and students can upload high-class resources to a certain PLE to let others learn, assess and propagate.

ELGG is an open source social networking software that provides individuals and organizations with the components needed to create an online social environment. It encompasses weblogging, file storage, RSS aggregation, personal profiles, collaborative community, and a number of other features. ELGG is free and open, running on the LAMP (Linux, Apache, MySQL, and PHP) platform. ELGG is widely implemented in educational institutions. Learners can find partners according to tags, collect, classify and share their favorite resources, activate built-in RSS subscription, and integrate with QQ, Wiki, and Google Reader as well. Constructing PLE on the basis of ELGG entails a powerful learning platform composed of modules such as learning management, smart recommendation of learning material, collaborative learning, BBS, and the like, which are generally needed when

establishing an individual online environment.

iGoogle, a service of Google, is a customizable Ajax-based startpage or personal web portal. With iGoogle, users can select unique themes for their homepages. iGoogle gadgets interact with the user and use the Google Gadgets API (Google also allows users to create a special gadget that does not require the use of the Gadgets API.). Constructing PLE on the basis of iGoogle provides one-stop service for users according to their customization, without any extra endeavor to switch among several pages. It is able to merge Google Group, Gmail, Google Calendar, Google Reader, Google Map, Google Scholar and so on into learner's homepage, even though the information sources are scattered. In addition, learners are allowed to add additional modules or plug-ins in a visualized way through dragging and dropping.

eyeOS is a web desktop following the cloud computing concept that seeks to enable collaboration and communication among users. It is a private-cloud application platform with a web-based desktop interface, with file management, personal management information tools, collaborative tools and integration of client's applications. Moodle (acronym for Modular Object-Oriented Dynamic Learning Environment) is a free software e-learning software platform, also known as a Learning Management System. Moodle can be used in many types of environments such as in education, training and development, and business settings. Some typical features of Moodle are assignment submission, discussion forum, grading, online calendar, online quiz, etc. Integrating eyeOS with Moodle by invoking Moodle's API in eyeOS helps to get an application system on cloud infrastructure to provide learners with personalized service. So that learners can access their resources and services via web browsers on handheld terminals like iPhone, iPad, PDA, etc. Constructing PLE on the basis of eyeOS and Moodle mainly provides three useful tools, i.e. tools for collecting information such as RSS feeds, networking digest, search engine, FTP and the like, tools for processing information such as Blog, Wiki, IM and the like, and tools supporting learning behaviors under Moodle.

COMPARATIVE RESULTS

As a new learning environment form, PLE provides personalized services and open space for users. Different construction ways and technologies mentioned above lead to multi-purpose PLEs, with merits and drawbacks each. In practice it is beneficial to select one or modify or even mix up several methods according to specific requirements. To this end, it is advisable to get a clear understanding of their advantages and application scopes by comparative analysis.

In general, measurement of assessing an online learning environment include Lias and Paul's five dimension indicator consisting of content accessibility, tool, interaction, learning support and online assessment (Basioudis & Paul 2009), Li's five driving factors which is comprised of information, interaction, evaluation, support and aesthetics (Li 2009), and Zhang's eight-indicator system including instructional design, content design, website design, flexibility, student interaction, teaching support, technical support and assessment (Zhang 2004). Inspired by these indicators, we propose the following evaluation dimensions for PLE.

(1) Content Management: About its provision of or extensibility to encompass cognitive tools, search tools, e-labels, article management tools (such as Network Digest, ZhuaXia, XianGuo), as well as other similar tools to help learners read, label, and share resource content.

(2) Learning Interaction: About its provision of or extensibility to integrate Instant Messenger, Wiki, microblog, E-mail, etc. to facilitate interaction between students and students, students and teachers, or even teachers and teachers during course learning, personalized learning or lifelong learning.

(3) Mentoring Support: About mentor's intervention when it is needed, especially when students have difficulty in a certain knowledge point or problem-solving and need guidance or help from teachers. In this case, mentors should be allowed to intervene directly on the PLE, by examining students' learning process, answering questions in time, offering new suitable material, giving feedbacks or suggestions, and so on.

(4) Technical Support: About PLE's technical support for favorites collection, classification, personal homepage customization, etc.

Table 1 Comparative analysis of the associated technologies

Technologies Items compared		360doc	Blog	ELGG	iGoogle	eyeOS +Moodle
Content	Content learning	√	√	√	√	√

Management	Google search		√	√	√	√
	RSS subscription	√	√	√	√	√
	e-Calendar		√	√	√	√
	Network digest	√	√	√	√	
	Tag	√	√	√	√	√
	ZhuaXia		√			
	XianGuo		√			
Learning Interaction	QQ		√	√	√	
	Wiki		√	√	√	√
	Microblogging		√	√		
	E-mail		√	√	√	
	Real-time chat room					√
Mentoring Support	Notification release		√	√	√	√
	Learning guidance		√	√	√	√
	Uploading resource	√	√	√	√	√
	Instant feedback		√	√	√	√
	Synchronous updating of supporting resources					√
Technical Support	Favorites Collection	√	√	√	√	√
	Favorites Classification	√	√	√	√	√
	Favorites Sharing	√	√	√	√	√
	Integration of multimedia resources	√	√	√	√	√
	Modules / plug-ins customization		√	√	√	√

(1) Content Management

In 8 sub-items of content management, Blog owns 8, iGoogle and ELGG both own 6, eyeOS+Moodle owns 5, and 360doc 4. Comparatively speaking, owing to its compatibility and extensibility, Blog provides more powerful content management functionalities than other four technologies. Especially in China, ZhuaXia and XianGuo are popular online / mobile reading websites supported by RSS, so that it'll be more convenient to integrate them into a PLE. As a result, when building a PLE in the case of collecting, filing and reflecting what has been marked down, Blog is more suitable. While if reading, sharing or classifying is enough, 360doc can be a good choice to establish personal digital library.

(2) Learning Interaction

Among the five technologies, only 360doc can not integrate any communication tools. As a result, its interactive learning functionality is weak, especially instant interaction. On the contrary, Blog and ELGG both have the advantage of integrating common communication tools, and iGoogle is roughly the same, whereas eyeOS+Moodle is capable of integrating Wiki and real-time chat room. That is to say, collaboration among partners is available in most of these technologies, no matter in the form of real-time (QQ) or non real-time (Wiki, e-mail). Consequently if real-time discussion and interaction is required when constructing a PLE, Blog, ELGG, iGoogle or eyeOS+Moodle is preferable, otherwise 360doc is acceptable to deliver normal reading, filing and sharing

functionalities.

(3) Mentoring Support

Among the five technologies, only 360doc's mentoring support is weak, as it merely provides mentors with resource uploading and sharing. In contrast, the remaining four support notification release to inform learners of some announcement, learning guidance to give instructions to learners so that they'll be clear about learning goal and requirement, instant feedback to enable mentors to join in learners' PLE group and give real-time support. Moreover, eyeOS+Moodle easily assists synchronous updating of supporting resources, as it's usually administrated by teacher, matching course topic, content and resource in a much closer way, and it supports almost all common learning resources as well, e.g. teaching video, exercise / homework, teaching case, special subject learning website, etc.

(4) Technical Support

From the integrity and extensibility point of view, PLE should be equipped with basic functionalities like favorites collection, classification and sharing. Fortunately five selected technologies fulfill these needs by enabling users to store up favorite documents, catalog personal collection, share their collection with others, and subscribe others' collection, etc. In addition, the constructed PLE should support common types of multimedia resources, such as Flash courseware, PowerPoint, JPEG image, MP4 video, HTML or JSP web pages, and the like. Results show that these selected technologies basically meet this challenge. Comparatively speaking, Blog limits resource type to image, audio and video, which relatively weakens its usability. When it comes to modules or plug-ins customization, 360doc shows a lack of user definition, while the other four enrich the PLE infrastructure through a variety of ways. For example, ELGG facilitates users by offering simple interface for adding Blog, tag, calendar, group and activity modules. In general, the above five technologies give sufficient technical support for users to customize their learning platform according to individual needs.

As is shown above, overall functionality of PLE built on the basis of Blog or ELGG is robust. In practice Blog is a bit more popular because of its adaptability in many application fields. Moreover, building PLE on Blog requires less workload since it is widely used. While ELGG seems more official and compatible owing to its open architecture, which gives highest customization in selecting and adding tools, plug-ins, and services. iGoogle also matches almost all "requirements" listed in table 1, except that it seems to work well with Google suites, e.g. Gmail, Google Calendar, Google Reader, etc. Being a kind of VLE and usually administrated by teachers in stead of learners, eyeOS+Moodle shows deficiency in interaction or online communication, but its supporting resources are superior to the other four technologies.

In summary, 360doc is applicable when interaction and mentoring support are not mandatory in designing a PLE, suitable for personal reading and writing with great content management potential, Blog is so popular that we can put it down as the first choice in informal situation, ELGG is suitable for building PLE in need of open standards and open APIs allowing users to 'plug in' their own favorite tools and providing interoperability with other applications, e.g. under the circumstances of course learning where students aggregate their own learning tools according to their personal needs, iGoogle is suitable for constructing personal web portal incorporating Google toolkits by default, and eyeOS+Moodle is preferable when building PLE closed to curriculum instruction and the VLE currently used is easy to extend or update (some monolithic VLEs are too hard to customize at the individual user level (Severance, Hardin & Whyte 2008)), without imperative request for instant messaging.

CONCLUSION

The idea of a Personal Learning Environment recognizes that learning is continuous and seeks to provide tools to support multi episodic learning -- learning will take place in different contexts and situations and will not be provided by a single learning provider. With the growth of Web 2.0 and Rich Internet Application (RIA) technologies, PLE has gained increasing attention since 2004. This paper elucidates PLE's definition and characteristics, and clarifies three different ways of constructing PLE, i.e. building PLE on the basis of social software, social aggregator, and VLE, within which at least one representative technology is selected to make comparative analysis in detail. Results show that each of the selected five technologies has its own advantage and application scope. Users may refer to the above suggestion when customizing learning environment in practice.

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