

10-1-2019

A Study of Creating Personal Learning Environments by Students of the Faculty of Education Majoring in Computer Education(การศึกษาการใช้สภาพแวดล้อมการเรียนรู้ส่วนบุคคลของนิสิตครุศาสตร์สาขาคอมพิวเตอร์ศึกษา)

Chayakarn Keereerat

Follow this and additional works at: <https://digital.car.chula.ac.th/educujournal>



Part of the [Education Commons](#)

Recommended Citation

Keereerat, Chayakarn (2019) "A Study of Creating Personal Learning Environments by Students of the Faculty of Education Majoring in Computer Education(การศึกษาการใช้สภาพแวดล้อมการเรียนรู้ส่วนบุคคลของนิสิตครุศาสตร์สาขาคอมพิวเตอร์ศึกษา)," *Journal of Education Studies*: Vol. 47: Iss. 4, Article 10.

Available at: <https://digital.car.chula.ac.th/educujournal/vol47/iss4/10>

This Article is brought to you for free and open access by Chula Digital Collections. It has been accepted for inclusion in Journal of Education Studies by an authorized editor of Chula Digital Collections. For more information, please contact ChulaDC@car.chula.ac.th.



การศึกษาการใช้สภาพแวดล้อมการเรียนรู้ส่วนบุคคลของนิสิตครุศาสตร์สาขาคอมพิวเตอร์ศึกษา

A Study of Creating Personal Learning Environments by Students of
the Faculty of Education Majoring in Computer Education

ชยการ คีรีรัตน์¹ ใจทิพย์ ณ สงขลา² และ ศิริเดช สุชีวะ³

Chayakarn Keereerat, Jaitip Na-Songkhla, and Siridej Sujiva

บทคัดย่อ

การวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาองค์ประกอบของสภาพแวดล้อมการเรียนรู้และกระบวนการภายใต้สภาพแวดล้อมการเรียนรู้ส่วนบุคคลของนิสิตครุศาสตร์สาขาคอมพิวเตอร์ ตัวอย่างที่ใช้ในการวิจัยเป็นนิสิตสาขาคอมพิวเตอร์คณะครุศาสตร์จุฬาลงกรณ์มหาวิทยาลัยที่เรียนรายวิชาการเรียนโปรแกรมคอมพิวเตอร์ จำนวน 37 คนได้มาด้วยการเลือกแบบเจาะจง เครื่องมือที่ใช้ในการวิจัย คือแบบสอบถามและแบบสังเกตการใช้สภาพแวดล้อมการเรียนรู้ส่วนบุคคล เก็บรวบรวมข้อมูลระหว่างภาคเรียนและภายหลังจบภาคเรียน วิเคราะห์ข้อมูลโดยใช้ค่าสถิติพื้นฐานได้แก่ ร้อยละ ค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน และวิเคราะห์เนื้อหาจากผังความคิด ผลการวิจัยพบว่า 1) องค์ประกอบของสภาพแวดล้อมการเรียนรู้ส่วนบุคคลที่ผู้เรียนส่วนใหญ่เลือกมี 3 ด้าน คือ ด้านบุคคล ประกอบด้วยผู้สอน ตนเอง และเพื่อนร่วมชั้นเรียน ด้านแหล่งข้อมูลเนื้อหาสาระประกอบด้วยหนังสือหรือเอกสารที่ผู้สอนแจก แหล่งข้อมูลที่ผู้สอนแบ่งปันบนเน็ตเวิร์กไดรฟ์ แหล่งข้อมูลจากการค้นหาด้วยโปรแกรมค้นหา เว็บไซต์เครือข่ายสังคม เว็บไซต์แหล่งความรู้เจ้าของเนื้อหา หนังสือเอกสารแหล่งอื่น และด้านการสื่อสารได้แก่การสื่อสารแบบเผชิญหน้าในห้องเรียน การใช้ Google drive กลุ่มไลน์ และ บล็อกความรู้ต่าง ๆ 2) ผู้เรียนมีค่าเฉลี่ยกระบวนการเรียน

Article Info: Received 15 September, 2015; Received in revised form 3 October, 2018; Accepted 10 August, 2019

¹ นิสิตศึกษาระดับบัณฑิตศึกษาเทคโนโลยีสารสนเทศและการสื่อสาร ภาควิชาเทคโนโลยีสารสนเทศและการสื่อสาร คณะครุศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย อีเมล: chayakarn.etc@gmail.com
Ph.D. Candidate in Division of Educational Communication and Technology, Department of Educational Communication and Technology, Faculty of Education, Chulalongkorn University Email: chayakarn.etc@gmail.com

² อาจารย์ประจำสาขาเทคโนโลยีสารสนเทศและการสื่อสาร ภาควิชาเทคโนโลยีสารสนเทศและการสื่อสาร คณะครุศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย อีเมล: jaitip.n@chula.ac.th
Lecturer in Division of Educational Communication and Technology, Department of Educational Communication and Technology, Faculty of Education, Chulalongkorn University Email: jaitip.n@chula.ac.th

³ อาจารย์ประจำสาขาวิชาวิจัยและประเมินผลการศึกษา ภาควิชาวิจัยและจิตวิทยาการศึกษา คณะครุศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย อีเมล: siridej.s@chula.ac.th
Lecturer in Division of Educational Measurement and Evaluation, Department of Educational Research and Psychology, Faculty of Education, Chulalongkorn University Email: siridej.s@chula.ac.th

รู้ตามองค์ประกอบ ด้านบุคคล 44.22 ด้านแหล่งข้อมูลเนื้อหาสาระ 38.54 และด้านการสื่อสารเป็น 17.97 ตามลำดับ

คำสำคัญ: สภาพแวดล้อมการเรียนรู้ส่วนบุคคล / กระบวนการเรียนรู้ / ความคิดรวบยอดของสภาพแวดล้อมการเรียนรู้ส่วนบุคคล / กระบวนการสภาพแวดล้อมการเรียนรู้ส่วนบุคคล / เทคโนโลยีเว็บ 2.0

Abstract

This study aims at exploring the components and learning processes of personal learning environments shaped by students of the Faculty of Education majoring in computer education. The participants of the study were 37 students of the Faculty of Education at Chulalongkorn University who took computer programming courses selected using the purposive sampling technique. The research instruments were a questionnaire and an observation form about making use of personal learning environments. The data were collected during and after the semester, analyzed using standard statistics, namely percentage, average, and standard deviation, and examined as concept maps. The results showed that there were three components of personal learning environments that the majority of the participants chose: *people*, comprising instructors, learners and their classmates; *content*, consisting of books and materials that the instructor gave and shared on the network drive, sources that were accessed via search engines, social network sites, academic sites, and other books and documents; and *communication*, involving face-to-face communication in classrooms, the use of Google Drive, Line app groups, and knowledge-sharing blogs. It was also found that the learners showed an average score for each learning process according to the components as follows: 44.22 for *people*, 38.54 for *content*, and 17.97 for *communication*, respectively.

KEYWORDS: PERSONAL LEARNING ENVIRONMENT / LEARNING PROCESS / PLE CONCEPT / PLE PROCESS / WEB 2.0 TECHNOLOGY

Introduction

Learning environments are a key learning factor which ordinarily encompass physical locations, contexts, and learned cultures. Learners can learn in a variety of different locations, such as in and outside classrooms, as well as in outdoors spaces. Furthermore, institutional and class cultures,

individual characteristics, reactional and interactional methods, and the ways that teachers shape environments also impact learning (Bates, 2015).

As Information and Communication Technology (ICT) has been making great strides in recent years, people can now better communicate with each other any time and transfer various forms of knowledge using electronic platforms. Learning environments thus change from physical learning environments to electronic learning environments or Virtual Learning Environments (VLE). This change makes the learning process adopted by present-day learners different from preceding generations. Today's learners gain knowledge in a way that allows them to select their preferred learning method, control the pace of their learning, and better manage their learning. Additionally, the learners can communicate and share their learning experiences with others in virtual communities simultaneously (Arrufat & Sánchez, n.d.). These factors have led to the development of personal learning environments (PLEs).

The concept of PLEs originates from the learner-centered approach using 'social software,' which refers to any software that serves to connect people and aid communication and collaboration (Schaffert & Hilzensauer, 2008). Social software generally includes a range of software applications, generally being online applications using web 2.0 technology which allows learners to communicate freely in daily life and work together. The software also promotes collaboration among members of a community or friends via social networks such as blogs, wikis, instant messaging, social bookmarking, and media sharing (Schaffert, 2006), as well as other online applications which can serve as learning management tools allowing learners to manage the lesson content and other resources by themselves and which cater to different personal learning styles.

Presently, more academic institutions are supporting resources for virtual learning management in the form of Learning Management Systems (LMS). Some LMSs like Blackboard are shared in an institution and some like Moodle are developed from open software sources by university faculties or departments. However, the LMSs that universities use present certain limitations in that they can be too rigid and inflexible (Mott, 2010), for example, in terms of the right to access information, the management of information structure, and fixed learning models depending on the LMS. This causes the LMS to be used along the same lines of the traditional classroom instruction model whereby teachers are the center of learning. As Downes (2005) put it, the LMS is a standard organizer of course content consisting of a curriculum, lessons, and other learning supports such as tests, testing, and discussions, which fall out of the range of a PLE.

Valtonen et al. (2012), based on Attwell (2007) and Schaffert and Hilzensauer (2008), defined a PLE as a tool which the instructor provides to learners and which the learners use to learn, comprising two crucial elements: firstly, the students are permitted and encouraged to create and manage their PLE as appropriately as possible to suit the needs and objectives of learning, and secondly, the PLE allows learners to play a greater role as a self-regulator and ‘responsibilitator’ for their learning. The tool focuses mainly on teaching and learning, not technical devices or software. This corresponds to Dabbagh and Kitsantas (2011), which holds that a PLE can be both a technology and a pedagogical approach. In other words, it can be a social media tool that is regulated effectively and that learners can use to adapt the traditional learning models by developing and employing self-regulated learning skills as well as integrating formal and informal learning.

Although PLEs are modern and appropriate for the present-day learning environment in that they involve facilities to regulate and adjust learners' learning environments and promote the development of collaborative learning of those involved (Valtonen et al., 2012), knowledge about the supporting systems for the use of PLEs has so far been limited as the systems have not been widely studied. Therefore, investigating the ways in which learners create their PLEs and the learning processes that they adopt is highly intriguing. The present study aims to explore the components and processes that learners develop and adopt in their PLEs, to gain a better understanding of their learning models, bring about the development of teaching strategies and guide the creation of appropriate supporting systems for PLEs.

Objectives

1. To study the components of learners' PLEs
2. To study the learning processes that take place within the PLEs

Methodology

The current research is a pilot study of PLEs employing a participatory qualitative method.

1. Participants

The participants were 37 second-year and fourth-year students of the Faculty of Education at Chulalongkorn University who were enrolled in one of three courses in computer programming.

2. Instruments

The research instruments were a questionnaire about the use of PLEs and an observation form for the students' learning behaviors. The instruments

were validated from three of the technology and communication experts. The former was administered to the participants after the last session of the courses at the end of the semester; the latter was used to observe the learners' use of their PLEs during the semester.

3. Data collection

The sample group was given a participant observation form to fill out during the semester. After the courses finished, the students were asked to create concept maps and complete the questionnaire about their PLEs developed throughout the semester.

4. Procedure

4.1 In the first week of instruction, the instructors asked for basic information about the learners' use of information technology and their PLEs such as the use of the LMS that the university provides and other learning sources that they were using. They were also introduced to the concept of PLEs and their principal components and processes.

4.2 The instructors explained the learning activities in the courses which included collaborative activities between the instructors and the learners throughout the semester, reflections on learning, and an explanation of the relationship between the tools used in PLEs and learning processes. This was to give the learners an understanding of underlying reasons for learning management systems and to connect the learning tools to their learning processes. The learning activities allowed the learners to play two major roles:

4.2.1 Role of creating and managing their PLEs

The learning activities allowed the learners to create and manage their PLEs in the form most appropriate for their needs and establish

learning objectives with a focus on learning processes and learning management rather than technical tools such as software. Nevertheless, the learners were allowed to select and apply available resources in a way that they felt was most appropriate. The instructors conducted in-depth interviews in order to collect data on the use of learning resources such as materials, LMSs, digital media, and online social media that the learners were using to serve as a collaborative platform.

4.2.2 Role of regulating themselves and taking responsibility for their learning

The learning activities allowed the learners to regulate themselves and take responsibility for their learning and management of PLEs.

4.3 The instructors explained the concept of three component resources: human resources; learning resources in the form of hard copy and soft copy materials and resources on the Internet; and communication resources serving as channels used for instruction.

4.4 The instructors explained the concept of learning processes that had been adapted from Gagne's nine steps of instruction. This serves as guidelines for developing learning processes in PLEs along with learning via Web 2.0 technology to enable users to create, share, communicate, collect, and manage learning resources as well as to establish their own knowledge and to allow learning processes to come about.

4.5 The instructors summarized the steps of implementing learning activities in PLEs in the 7Cs model, which was adapted from Attwell (2007), Chatti (2007), Dabbagh and Kitsantas (2011), Valtonen et al. (2012) in order to contribute to learning in a PLE. The model is composed of the following components:

4.5.1 Collection

Collection covers gathering and seeking data, the contents that learners wish to learn, storage of data for learning obtained from various forms of media in the form of hard copy or soft copy materials, searching for data from electronic media, websites, data screening, and data organization.

4.5.2 Communication

Communication, both synchronous and asynchronous, allows for exchanging opinions, transferring data, asking and answering questions, reflecting on ideas, explaining ideas, examining the connection of ideas for synthesizing research, working with colleagues, organizing participatory activities, and managing people and other resources.

4.5.3 Collaboration

Collaboration refers to interaction with others to improve, correct, manage, and foster relationships with those who are not formally a part of a learning network.

4.5.4 Creation

Creation refers to establishing knowledge; creating concepts; taking notes; processing data to develop, improve, and adapt content by trying to understand, analyze, synthesize, summarize, and create knowledge and task objectives; and developing tasks based on desired learning objectives.

4.5.5 Contribution

Contribution encompasses contributing to created works through electronic media, online networks, social network services or any form of communication platform in order to increase the potential of PLEs and to collaborate for learning.

4.5.6 Control

Control involves controlling, managing and disseminating learning sources, working together, encouraging resource sharing, and describing information sources that one finds, obtains, selects, improves, collects, and disseminates through various channels such as blogs or Google Drive.

4.5.7 Combination

There can be any combination of learning sources, resources, experimentation, lesson studies, and learning.

4.6 In each week of learning management, the instructors collectively observed, followed, and reinforced the learners' use of tools and their learning processes. They also observed the learning processes of the learners so as to consider whether and to what degree the tools could improve the learning processes and address the learning problems being experienced by the learners.

4.7 In the last week of learning management, the instructors directed the learners to create concept maps of the PLEs used so as to reflect on their influence on their learning. More specifically, the steps were as follows:

4.7.1 The participants were asked to analyze data on their PLEs according to the procedure for implementing learning activities using the 7Cs model;

4.7.2 The participants were asked to synthesize the data into a concept map which illustrated the components and the processes that correlated to the weights of their PLEs;

4.7.3 The concept maps were analyzed to generate a questionnaire about PLEs; and

4.7.4 The participants were asked to complete the questionnaire

5. Data analysis

1. The researcher analyzed the components of the learners' PLEs by examining the content contained on each of their concept maps, carrying out participant observation, and conducting in-depth interviews.

2. The researcher analyzed the scores of the participants' learning processes from their PLEs by calculating the arithmetic means (M) and standard deviation (SD) of the scores obtained from the questionnaire about the participants' learning processes.

Results

Overall, this study explored the components and learning processes used in the learners' PLEs after one semester. The results are as follows:

The results based on the first objective of this research—to study the components of learners' PLEs through participant observation, in-depth interviews, and analyses of the learners' concept maps—are summarized below:

1.1 In terms of the component of *people*, the learners placed prime importance on the instructors, autonomous learning, classmates, outsiders connected through social networks or on the Internet, other outsiders, and friends in other fields of study.

1.2 Concerning the component of *content*, the learners valued two main types of sources. The first source included books or materials that the instructors had provided, whether in the form of hard copy or soft copy materials, whether in online media such as information sources that the instructors had shared on the Internet and network drives or in offline sources, for example, instruction through CDs or DVDs, books and other materials. The

second source covered information sources the students derived themselves from searching on the Internet such as websites, social networks, and academic-related websites.

1.3 The component of *communication*, including communication tools, falls into two broad categories: synchronous and asynchronous. The former generally involved face-to-face communication, online chatting, and telephoning, and the latter normally included forums, blogs, Google Drive, and offline chatting such as chatting via the Line application.

The three components are displayed in Figure 1.

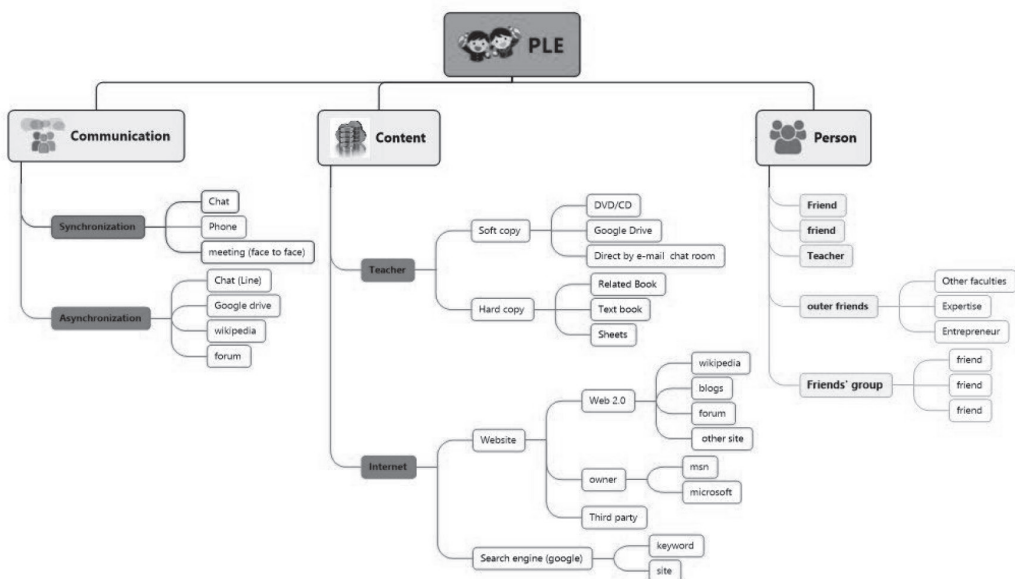


Figure 1 The three components of PLEs

The results based on the second objective of this research—to study the learning processes that take place in the students’ PLEs by synthesizing three components in the questionnaire, namely *people*, *content*, and *communication*, to derive scores for learning processes—are concluded below.

2.1 The scores for overall learning processes based on the three components indicates that 37 students valued *people* the most with an average score of 44.22 ($M = 44.22$), followed by *content* with an average score of 38.54 ($M = 38.54$), and finally *communication* (and communication tools) with an average score of 17.97 ($M = 17.97$). The results are displayed in Table 1.

Table 1 An average score for learning processes categorized by component

Learning processes implemented in PLEs by component	No. of students	Average score	SD
1. People	37	44.22	18.74
2. Content	37	38.54	16.83
3. Communication (and communication tools)	37	17.97	8.96

In terms of the learning processes based on *people*, 30 learners ranked instructors first, who were facilitators of learning with an average score of 45.39. In addition, 36 learners ranked learning autonomy as the second most important with an average score of 34.97, and 33 of them ranked learning with classmates third with an average score of 26.06. Moreover, the participants also learned from outsiders via the Internet and outsiders they knew, for example, entrepreneurs and friends in other fields of study, as exhibited in Table 2.

Table 2 Statistical scores for participants' learning processes based on people

People contributing to learning in the learning process	No. of the learners	Average score	SD
1. Instructors	30	45.39	18.13
2. Autonomous learning	36	34.97	27.06
3. Classmates	33	26.06	15.98
4. Outsiders through social networks or the Internet	12	13.19	8.33
5. Other outsiders	5	9.33	4.50
6. Friends in other fields of study	14	8.93	5.73

2.3 Concerning the learning processes from *content*, including tools, all 37 of the learners considered the books and materials that the instructors had provided as being the most crucial with an average score of 24.30. There are 32 learners used data sources that the instructors had shared on the network drive with an average score of 20.43. Meanwhile, 36 of them received information from Internet searches with an average score of 19.49. Furthermore, there are 30 learners used social network websites with an average score of 17.36. 28 of them valued content derived from product owners with an average score of 12.95. It was also found that 29 of the learners used other books and hard copy materials with an average score of 12.87, and only 13 learners used learning materials in the form of CDs and DVDs that the instructors had handed out with an average score of 12.56. The results are shown in Table 3.

Table 3 Statistical scores for the participants' learning processes based on content

Content sources	No. of students	Average score	SD
1. Books and materials provided by the instructors	37	24.30	15.44
2. Data sources shared on network drive by the instructors	32	20.43	12.69
3. Data sources derived from Internet search	36	19.49	13.40
4. Social network websites	30	17.36	17.31
5. Product owners' websites	28	12.95	8.37
6. Other books	29	12.87	12.05
7. Data sources on CDs/DVDs provided by the instructors	13	12.56	12.83

2.4 As for the learning processes arising from *communication*, including communication tools, in PLEs, all of the learners ranked face-to-face learning in classrooms first with an average score of 57.26. The other communication and communication tools that over half of the learners valued were ranked in the following order: 27 used of Google Drive with an average score of 15.32, 23 use Line groups with an average score of 12.83, 26 used knowledge blogs with an average score of 11.72, and 25 of them used emails at with an average score of 6.07. The communication and communication tools that less than a half of the learners used were personal Line (18 learners) with an average score of 8.63, Facebook for learning and exchange knowledge (11 learners) with an average score of 8.45, forums (13 learners) with an average score of 8.44, Facebook groups (6 learners) with an average score of 6.83, and other communication tools such as an LMS (3 learners) with an average score of 4.67, respectively. The results are summarized in Table 4.

Table 4 Statistical scores for the participants' learning processes derived from communication (and communication tools)

Communication (and communication tools)	No. of learners	Average score	SD
1. Face-to-face (Classrooms)	37	57.26	21.51
2. Google Drive	27	15.32	10.17
3. Line groups	23	12.83	8.46
4. Knowledge blogs	26	11.72	7.57
5. Personal Line	18	8.63	5.48
6. Facebook for learning and knowledge exchange	11	8.45	5.00
7. Forums	13	8.44	5.65
8. Facebook groups	6	6.83	2.69
9. Emails	25	6.07	3.85
10. Others	3	4.67	1.68

Discussion

This research examined learners' PLEs in terms of components and learning processes. The components of PLEs made use of by the students were divided into three broad categories: *people*, *content*, and *communication*. The component that the learners counted as being most important was that of *people*, with the highest priority given to instructors, themselves, and classmates, respectively.

Given the component of *content*, the learners valued most what had been provided by the instructors, with the first priority being hard copy materials and the second being soft copy materials that had been stored in social networks being and managed by the learners. This is in line with Kompfen, Edirisingha, and Mobbs (2008) who assert that a PLE is a system using Web 2.0 tools whereby learners can access, communicate, collect,

create, and share resources, thereby triggering learning. The Web 2.0 technology leads to integration in various dimensions such as an integration of content and communication when learners use search engines on the Internet and communicate with outsiders like owners of knowledge sources. Another example of such integration is an integration of data storage units such as Google Drive which can serve as a communication platform and online data collection space. In this case, Google Drive facilitates collaboration for exchanging electronic learning resources.

As far as *communication* is concerned, the use of Web 2.0 technology as a tool implemented in PLEs enables learners to select learning resources—including people, content, and communication—that suit their learning style and lifestyle. For instance, learners can contact an entrepreneur as an expert to obtain information. They can also access knowledge blogs and forums and use search engines to obtain knowledge for further use, conduct and disseminate research, and share their knowledge.

Considering the processes that take place in PLEs, the learners started off with collecting the books and materials provided by the instructors and paid particular attention to face-to-face learning in class with the instructors. Then they took on self-study with the use of the synchronous and asynchronous communication tools of Web 2.0 technology to meet their learning needs, show participation in instruction, and increase their learning space as a learning community. This is consistent with Attwell (2007) who maintains that PLEs allow learners who possess learning autonomy to be better able to regulate themselves. This also conforms to Harmelen (2006) who sees a PLE as a system which helps learners control and manage their learning as well as establish their learning objectives. The system equally can assist learners

in their learning experiences through learning resources, communication, academic institutions, and educational experiences; and those involved in collaborative learning can better manage their learning in terms of content, processes, and communication to achieve learning objectives. In the same vein, learners can seek additional information for making decisions and regulating themselves in their learning.

Even though learning resources easily and readily available on the Internet enable learners to learn more and in greater depth, there are some caveats that concern a lack of content checking, incomplete sources of information, and incorrect information. These can result in misconceptions about the subject matter. To reduce these instances, an instructor should serve as a teaching coach that encourages learners to use learning resources properly and give feedback.

What is more, instructors can prepare the following to satisfy students' learning needs and to allow them to use PLEs effectively: specifying sources of information, showing how to search using keywords, following-up on students' learning and discussing learning content with students' to allow them to perceive the weaknesses and correct them.

In the study, the above-mentioned activities triggered appropriate learning behaviors in virtual environments in which learners searched for information and content through the Internet, communicating and sharing knowledge so easily that the environments became 'real' in the sense that learners could manage their learning naturally, spontaneously, and automatically. These 'real' environments included public websites and electronic media that instructors created so that learners could adapt their learning models in accordance with ever-changing environments.

Meanwhile, the majority of the learners did not take advantage of the LMSs that the university provided. This is in line with Dabbagh and Kitsantas (2011) who points out that the LMS does not benefit from collaboration on social media due to its limited terms and conditions of use, for example, not permitting learners to manage and take care of learning spaces and connect with friends and social networks, and limited time and locations when LMSs can be accessed. These constraints thus prevent learners from exploiting digital technology and networks. Learners, in fact, want PLEs to be open and flexible (Mott, 2010; Valtonen et al., 2012). Further, LMSs, like university emails, do not make learners feel that the learning experience is part of their daily lives. Most learners used more public online platforms than the LMSs that the university provided. This corresponds to Harmelen (2006), who contends that a PLE should adhere to the learner-centric view. This differs from the principles of an LMS and virtual learning environments (VLE), both of which subscribe to an approach that puts the institution or curriculum, rather than learners, as its center.

A PLE can conform to the 7Cs learning model, which is comprised of the collection of data sources, communication, collaboration, creation, contribution, control, and combination. The seven processes may or may not take place in order. Some learning situations may contain all the processes, whereas others may involve only some of the processes. In this model, learners harness their own learning, both the processes and components.

Suggestions

1. This study suggests that a PLE should take into account the differences in learners' knowledge, skills, attitudes toward learning, and types of lesson content. Learning in PLEs can be achieved if instructors give learners

opportunities to choose and manage learning resources themselves and follow-up with them. It also requires appropriate learning assessment and coaching of students and allowing them to develop their collaboration through the creation of work, communicating constructively, and setting the learning situation appropriately.

2. It is also suggested that the systems that support PLEs should be developed effectively in that they must contain tools for accessing sources and services so that learners can collect, create, contribute, communicate, cooperate, and combine tools, communication, resources, and learning processes. In this way, learners are able to control resources and learning processes themselves, allowing instructors to access, communicate with and guide them so that they can learn in various situations.

The results of this study show that giving learners adequate feedback is a vital process of PLEs and can be done through individually looking at logs, as well as the formal and informal note-taking records of students. This provides a basis for teachers' follow-up and feedback to help motivate learners to meet learning challenges.

Therefore, a PLE should be designed in a way that can easily track learners' ideas or idea structures and allow teachers to make corrections and students to receive that feedback. PLEs need to permit learners to manage the environments and systems themselves so that they can adjust them to best meet their needs. They also require access to social networks and communication tools through which they can interact with a variety of people in daily life. This use of information technology promotes both formal and informal learning. The systems should allow learners to play a part in building and managing their own PLEs in the most appropriate form that suits their

needs and their learning objectives. They should also promote learners' ability in self-regulating, self-controlling, and taking responsibility for their learning.

Web 2.0 tools can be used to learn, reflect on ideas, self-assess, and work with other people. This positively affects learning and knowledge development and promotes learners' interaction and communication. Academic institutions can make use of unofficial software such as services on various websites to be used as learning environments. Then instructor can promote learning environments raising problems and boost learners' motivation according to their interest, resulting in greater participation in collaborative activities and the sharing of learning resources. In addition to PLEs supporting self-regulation and the modification of self-learning environments, they can also enhance collaborative learning in class. Nonetheless, learners will still need to possess high-order thinking skills for assessing and adjusting their learning processes, which would be an interesting area to explore for further research.

References

- Arrufat, M. J., & Sánchez, V. G. (n.d.). *Steps to reflect on the personal learning environment: Improving the learning process?* Retrieved from <http://revistas.ua.pt/index.php/ple/article/viewFile/1430/1316>
- Attwell, G. (2007). Personal learning environments the future of e-learning?. *Lifelong Learning*, 2(1), 1-8.
- Bates, A. T. (2015). *Teaching in a digital age*. Retrieved from <https://opentextbc.ca/teachinginadigitalage/chapter/5-2-what-is-a-learning-environment/>
- Chatti, M. A. (2007). *Personal-environments-loosely-joined*. Retrieved from <http://mohamedaminechatti.blogspot.com/2007/01/personal-environments-loosely-joined.html>

- Dabbagh, N., & Kitsantas, A. (2011). Personal learning environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *Internet and Higher Education*, 15(1), 3–8. doi:10.1016/j.iheduc.2011.06.002
- Downes, S. (2005). *E-learning 2.0*. Retrieved from <https://elearnmag.acm.org/featured.cfm?aid=1104968>
- Kompen, R. T., Edirisingha, P., & Mobbs, R. (2008). *Building web 2.0-based personal learning environments – A conceptual framework*. Paris: EDEN Research. Retrieved from [https://lra.le.ac.uk/bitstream/2381/4398/1/EDEN ResWksp 2008 Torres Kompen et al Web 2.0 PLE paper.pdf](https://lra.le.ac.uk/bitstream/2381/4398/1/EDEN%20ResWksp%202008%20Torres%20Kompen%20et%20al%20Web%202.0%20PLE%20paper.pdf)
- Harmelen, M. V. (2006). Personal learning environments. In *Proceedings of the sixth IEEE international conference on advanced learning technologies (ICALT '06)* (pp. 815-816). Washington DC: IEEE Computer Society.
- Mott, J. (2010). Envisioning the post-LMS era: The open learning network. *Future of Higher Education*, 33(1), 1-9. Retrieved from <https://er.educause.edu/articles/2010/3/envisioning-the-postlms-era-the-open-learning-network>
- Schaffert, S. (2006). *Semantic social software: Semantically enabled social software or socially enabled semantic web?*. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.107.8638&rep=rep1&type=pdf>
- Schaffert, S., & Hilzensauer, W. (2008). On the way towards personal learning environments: Seven crucial aspects. *eLearning Papers*, 2(9), 1-11.
- Valtonen, T., Hacklin, S., Dillon, P., Vesisenaho, M., Kukkonen, J., Hietanen, A. (2012). Perspectives on personal learning environments held by vocational students. *Computers and Education*, 58(2), 732-739.