Personal learning environments: A systematic literature review based on study keywords using thematic analysis

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Abstract

Throughout the last decade, there has been an important increase in the number of the Personal Learning Environment (PLE) research. However, there is a lack of recent systematic reviews covering the large amount of PLE studies. In this study, aforementioned gap is addressed using a hybrid method. This hybrid method is composed of Systematic Literature Review and Thematic Analysis Approach which are based on the keyword information of published PLE studies. As a result of our search query, we have reached 506 studies. Keywords of selected studies are recorded along with year of publication, study type and country of authors. We present the frequency distribution of all keyword themes (codes) and define the most frequent codes. We also share some trend graphics regarding the other study attributes (year of publication, study type and country of authors).

Keywords: Personal learning environment, PLE, personal learning, literature review, self-regulated learning.

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1. Introduction

Personal Learning Environment, as the term known today, was first coined by Van Harmelen [1]. However, there are some precursor studies in the literature as well [2], [3]. Throughout the last decade there has been a large amount of PLE research conducted by the researchers. Motivation behind this study is to review the accumulated PLE research and to highlight the key terms used in the related studies. There are not enough sufficient PLE review studies in the literature as noticed in a recent study [4]. First, we'll present some background information regarding PLE in the following paragraphs. In the next sections, we will continue with research methods used in this study, actual literature review, data results, conclusion, and future research.

We entered in a new era of education and it's not sufficient enough for learners and teachers to just reproduce current institutional practices which are simulated in the form of new technologies and software [5]. [6] Designates these practices or current educational paradigm as the dominant design of educational systems and PLE as an alternative challenger design pattern. Besides seven important aspects of the PLE, the significance of the content is declining due to knowledge created by social interaction and collaboration which is described in [7]. Paradigm shift in the education began to appear in the literature since 2010 more frequently. For example, student-centered learning highlighted in [8]–[10]. PLE approaches in the literature , circa 2010, are reviewed and criticized by [11]. Connections between Personal Learning Environments, social media, self-regulated learning, and PLE, as a bridge between formal and informal learning, have been examined as well [12]. Self-regulated learning is a crucial aspect for PLEs. However, providing such an agency of the learner has not been studied thoroughly yet. A model for self-regulation is designed and validated for K12 in a recent research [13].

The first review study, found in [4], examines approximately 100 papers in depth using Activity Theory [14]. The other research classifies the PLE research, circa 2012, into two broad categories (Technology and Education) and points out the necessity for a third category that combines technology and pedagogy fields [15]. There is no widely accepted guideline for building personal learning environments. However, there are some attempts to tackle this issue in the latest literature. A principle set (Integration, Openness, Distributed Identity Management, Context Awareness, Modularity, Ubiquitous Data Access, User Centricity) is proposed in [16]. Scenarios, regarding the co-existence of Learning Management Systems with Personal Learning Environments and some PLE framework alternatives, are studied in [17]. An architecture proposal for a mobile workplace PLE and its implementation is presented in [18].

2. Research Methods

2.1. Systematic Literature Review

Systematic literature review in software engineering has a de facto methodology which has been borrowed from medicine [19]. This methodology has been used in two thousand and three hundred studies (Google Scholar's citation count) as of February 2017. We used this methodology in this study as well. The three stages of the methodology are planning, conducting and documenting the review.

2.2. Thematic analysis

Thematic analysis is the identification of codes and themes within the raw data by clustering it based on similarities. A thematic analysis guideline for a psychology application can be found in [20]. In this study, the keyword terms captured from papers under review is used as the raw data.

3. Literature Review

3.1. Research Questions

In this study, we intended to answer the following questions:

Research Question 1: What are the most frequently used keywords in the PLE studies?

Research Question 2: What is the distribution of studies in terms of Year of Publication, Study Type and Country of Researchers?

3.2. Search strategy

We designed a search string based on the questions mentioned above. In order to increase the relevancy and prevent from an infeasible amount of output, search statement is only limited to work in the titles of papers. Search string is as follows:

Allintitle: ("personal learning environment" **OR** "personal learning environments")

3.3. Literature resources

Google Scholar was our primary literature resource. It has a pretty high coverage of 87 % [21] for studies published in English. Hence, it saves researchers a lot of time as a Meta academic library. However, Google Scholar has some drawbacks as well [22]. Our search covers the studies published till December 2016 with no start date specified. We also added another filter on the content search. We conducted the search by using "Allintitle" keyword to limit the search within paper titles. In this manner, we tried to increase relevancy and reduce the size of the search output.

3.4. Study selection process and quality assessment

We obtained 506 studies after executing the search string. In the first filtration phase, we made a quick scan of the abstracts of all the resulting papers and made elimination based on the following inclusion and exclusion criteria. There was no any other extra quality assessment procedure applied.

Inclusion Criteria:

- Paper must contain studies in PLE field.
- Studies must be reviewed in peer reviewed workshop OR conference OR journal OR book chapter OR are reported in a technical report OR MS/PhD thesis.

Exclusion Criteria:

- Studies that are not in English

After the first filtration, 424 papers remained for the second phase. In the second phase, keywords of the remaining 424 papers, Year of Publication, Country of Authors and Study Type have been recorded.

3.5. Data extraction and data synthesis

We extracted the following data from the selected papers to reach the data needed to answer our research questions and present additional statistical information: Title, Year of Publication, Study Type, Country and all keywords or index terms. If keywords are not found in the study, the words in the title will be used as keywords. Next, extracted keyword data was synthesized using thematic analysis.

4. Data results

In this section, the research questions given in section 3.1 will be examined.

4.1. Research question 1

There have been 1829 (~4.3 keywords per paper) actual keywords captured and among them 985 are unique. The unique keyword number is pretty high and they are not suitable for analysis. On the other hand, there are a lot of different keywords with similar meanings. Therefore, there is a need for grouping or clustering similar keywords into representative codes or refined keywords using thematic analysis. Following the method in section II, sub-section B, all recorded keywords are scanned and assigned a code. 219 unique codes are remained when this operation is completed. Most frequent codes whose frequency values are greater than 19 are shown in TABLE 1.

The first 10 codes in TABLE 1 are defined based on the gathered keywords and our interpretation as follows:

Personal Learning Environment: We define the concept as the convergence of the pedagogy science and the technology which enables the learner to lead his/her learning process.

Web 2.0: The tools and technologies enable Web users not only to read the content but also produce and share it. Keywords such as "widget", "semantic web", "iGoogle gadgets" are classified under this code together with the same keyword variants such as "Web-2.0" and Web 3.0, 4.0 and 5.0 followed Web 2.0 [23], respectively.

E-Learning: The learning process is made more efficient by using multimedia and electronic. Keywords such as "web learning", "distance education", "E-portfolio" are classified under this code together with the same keyword variants such as "elearning".

Self-regulated Learning: [24] defines the term as "Self-regulated learning (SRL), as the three words imply, emphasizes autonomy and control by the individual who monitors, directs, and regulates actions toward goals of information acquisition, expanding expertise, and self-improvement." Keywords such as "autonomy", "Student's control", "Self-directed learning", "agency", "Heutagogy", "intrinsic motivation", etc. are classified under this code together with the same keyword variants such as "self regulated learning".

Table 1. Most frequent codes

Code	Frequency
Personal Learning Environment	387
Web 2.0	94
E-Learning	86
Self-regulated Learning	68
Analytics	60
Collaborative Learning	45
Higher Education	42
Case Study	42
Social Media	35

Virtual Learning Environment	33
Research	32
Social Learning	31
Mobile Learning	30
Learning Management System	28
Personalized Learning	26
Standards	25
Workplace Learning	24
Lifelong Learning	23
Mash-up	23
Design	21
Architecture	21
ICT	19
Usability	19
Cloud	19

Analytics: Discovery and reporting of knowledge from raw data. All terms serving that objective is grouped into this code. Some example terms are "recommender systems", "attribute", "genetic algorithm", "visualization", and "neural networks". Learning analytics is the application of analytics to the learning discipline.

Collaborative Learning: A collective work of a group of people aiming to generate a product or artifact of their learning process [25]. "Online Learning Communities", "collective intelligence", "Community of practice", "Cooperative learning", "Learner interactions", "Practice sharing" are some of the keywords summed up into this code.

Higher Education: The optional education phase takes place in universities or other similar institutions such as colleges and academies after K12 education.

Case Study: All keywords regarding personal learning cases or experiments conducted in the context of a university, high school, workplace or other places such as museums are classified as Case Study.

Social Media & Social Learning: Social media is a set of technologies that enables information sharing by virtual communities [26]. On the other hand, social learning theory assumes that learning occurs in a social context [27].

Virtual Learning Environment (VLE): Basic features of VLE is given in [28]. Keywords such as "virtual classroom" and "virtual campus" are classified under this code together with the same keyword variants such as "VLE".

Remaining codes with their frequencies in parenthesis are given as follows: Distributed Systems, Blogging, Informal Learning (16), Tool (15), Adaptability, K12, Interoperability, Language Learning, Knowledge Management (14), MOOC, Learning Environment (13), Theory (12), Learning, Model (11), Assessment, Guidance, Pedagogy (10), Learning Networks, Technology Enhanced Learning, Connectivism, Learning Analytics (9), Educational Technology, Teacher Training, Personal Learning,

Digital Literacy, Learning Content, Web, Approach (7), Learning Technology (6), Technology, Accessibility, Ubiquitous Learning, Evaluation, Online Identity, Disability, Teaching-learning process, Security, Interactive Learning Environment, Learning Activities (5), Smart City, Constructivism, Student Profile, Evolution, Competence (4), Students, Formal Learning, Pervasive Computing, Teaching, Gamification, Elgg, Personal Development, Digital Native, Computer-mediated communication, Validation (3), Environment Comfort, Creative Commons, Educational Environment, Automated monitoring, Scaffolding, Gender, Viable System Model, Glocality, Course Design, Android, Project Based Learning, Building, Serendipity, Inquiry-based Learning, Digital Storytelling, Cognition, Education, Computer Science, Urban Computing, Learning Engagement, Performance, Learning Experience, Platform, Concept, Rating, Concept Formation, Search, Learning Scenario, Environment, Adulthood, Achievement, context awareness, Trust, Educating, Experiential Learning (2), Comparison, QTI, Students' Readiness, Embedded, Data Exchange, HOU2LEARN environment, Socio-cultural, Learning Flow Management, Learning Behavior, Hybrid Learning Environment, Recall, BLTI, Co-inquiry, Learning Object, Ambient Learning, Learning Objectives, Status Functions, Imam Al-Ghazali (RA), Teaching Journalism, Conceptual Differences, Traditional Mode, Boundary Objects, Quantified Self, Live Annotation, Reputation, Constitutive Entanglement, Rubric, Mass Media, Self-Evaluation, Mathematics Education, Smart Learning Environment, Metalearning, social ontology, Minhajul Abidin, Software Project Perspective, Emergence, Acceptance, Content, Complementarily/Substitution, Information Retrieval, Digital Resources, Mood-driven, Assistance, Multimedia, Augmented Reality, Innovation, Quantified Learning, Flexibility, Goal Setting, Application, Relevant Concept, GLUE!, Requirements Engineering, weSPOT, RLO Dynamic Assembly, Educational Scenarios, Knowledge-based society (KBS), Control Engineering, Data-driven Inquiry, Interesting Alternative, DBR, Open Education, Educational Services, Open Platform, SNS, Open Source, Digital Environment, Pattern Languages, Social Status, John Searle, Socio-materiality, JOL, Digital Events, Performance Augmentation, STEM, Emergent Learning, Behavior Recording, Judgment of Learning, Task Strategy, CSCL, Evaluation of Framework, Cybernetics, Auto-ethnographical Reflections, Engagement, Digital Storage, Applied Computing, Timeline-based, Practice-oriented Approach, TPACK, Problematisation, Big Data, Professional Orientation Work, Edutainment, Knowledge, OP4L, Netvibes, Video Cast, Network Education, Virtual Reality, nQuire, Educational Innovation, Objectivism, Educational Research, OLE, Online Ethnography, Learning Agent (1).

4.2. Research question 2

The trend of the number of the studies per publication year is shown in Fig. 1. There's a dramatic increase in the number of the studies between 2007 and 2011. Inversely, a decline seems to begin starting from 2014. Countries that have more than 10 studies are given in Fig 2. Studies which have authors from multiple countries are ignored in this graphics. European countries together with USA, China and Australia seem to have the highest investment in the PLE research. Journal and conference papers are the dominating group as shown in Fig. 3.

5. Conclusions and Future Research

We performed a systematic literature review covering the research concerning personal learning environments. Keywords specified in the selected papers were categorized and most frequent themes have been identified. Complete list of themes with recurrence counts were also reported. Trend graphics for the year of publication, country of authors and study type were also analyzed. Research following is planned to be conducted in the future:

- An additional review using other research libraries such as web of science, Ebscohost and research gate to confirm this study
- Enhancement and validation of the architecture proposed in [4] using the results of this review and a survey data captured in a workplace environment

Bagriyanik, S. & Karahoca, A. (2017). Personal learning environments: A systematic literature review based on study keywords using thematic analysis. *New Trends and Issues Proceedings on Humanities and Social Sciences.* [Online]. 4(4), pp 122-130. Available from: www.prosoc.eu
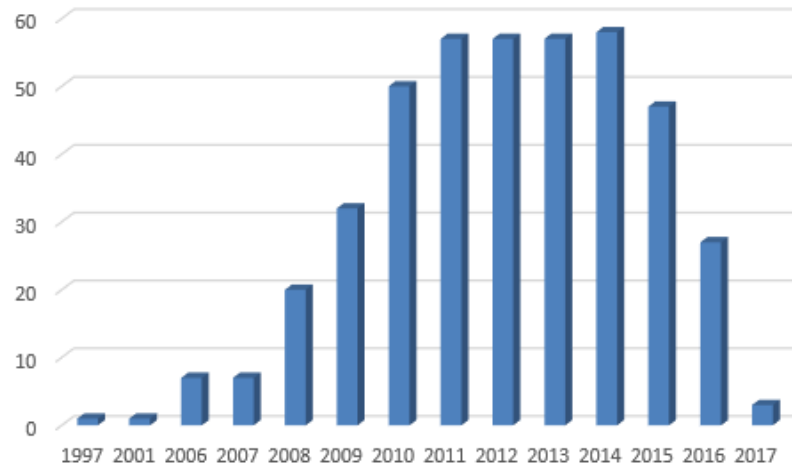
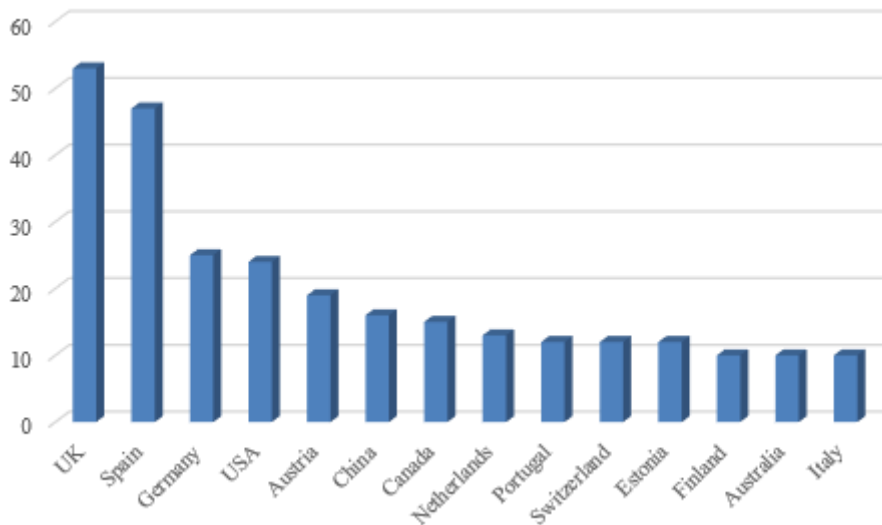**Figure 1**. **Distribution of studies by year of publication**

Figure 2. Distribution of studies by country of authors

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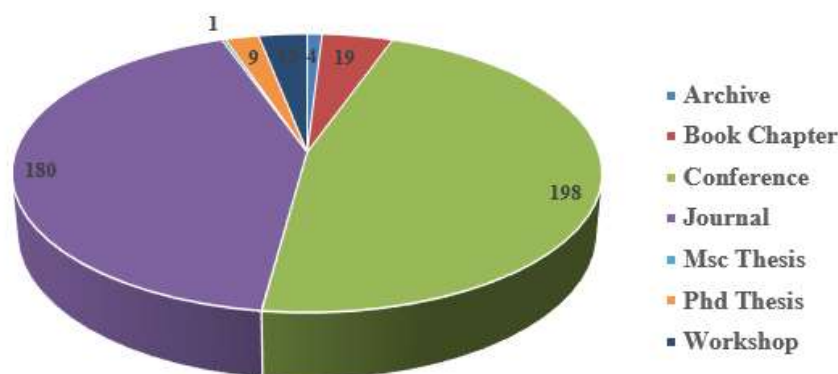
Figure 3. Distribution of studies by type

Acknowledgment

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