

# Digital Skills for Building and Using Personal Learning Environments

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In the competitive worldwide reality, there is a need for lifelong learning. People need to continuously learn new knowledge, acquire new skills, and adapt to new situations. PLEs could support this continuous learning necessity. However, the learner should have specific digital skills for PLE development and management. This paper addresses these needed digital skills. Initially, the paper introduces a PLE model to present how the learner uses applications to access and manage resources in order to develop his/her PLE. Then, it describes the stages that the learner follows in order to collect, manage, develop, and share resources as well as communicate and collaborate with others in his/her PLE. Finally, the paper presents the digital skills needed by the learner in order to develop and manage a PLE.

**CCS CONCEPTS • Applied Computing • Education • E-learning**

**Additional Keywords and Phrases:** Personal Learning Environments, Digital Skills, PLE, Lifelong Learning, Personalized Learning, Autonomous Learning

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## 1 Introduction

The trend to autonomous, ubiquitous, personalized, and experiential lifelong learning anywhere anytime brings to the frontline the Personal Learning Environments (PLE). Previous studies defined PLE as either a technological tool or a pedagogical concept [1, 2, 3, 4, 5, 6]. In the first case, PLE is considered as a digital platform that was built by programmers and educational experts while in the second case PLE is considered as a learning method where each learner collects and organizes the resources using digital technologies according to own needs and preferences [4, 7, 8]. A PLE is like a content management system or a social network owned and managed by the independent learner who can also communicate and collaborate with others [1, 2].

PLEs enable learner-centered learning [8, 9, 10] and personalized learning [3, 9, 11, 12] since the learner takes control, ownership, and responsibility of his/her goals. Thus, PLEs enable self-regulation [9, 10, 13, 14]. Since self-regulation is needed for lifelong learning [11], PLEs are well suited to lifelong learning [7, 8, 13, 15, 16].

In a PLE, the learner uses digital tools to direct own learning by selecting and organizing educational resources as well as communicating and collaborating with others [4, 9]. The learner may use a variety of technologies and tools such as communication and collaboration tools, scheduling, time management and calendar, authoring and publishing tools [6, 10, 11, 17]. So, it is clear that the learner needs to have digital skills in order to design and manage his/her own PLE [8, 18, 19, 20, 21, 22].

In the literature, there is a confusion about what digital skills encompass. Previous studies e.g., [23-35] use a variety of different terms (e.g., digital competence, digital literacy, digital skills, ICT skills, ICT literacy, information competency, information literacy, media literacy, media skills, technical skills) to describe/outline the basic skills needed for finding, evaluating, developing, using and sharing digital resources as well communicating and collaborating with others using digital technologies. Although many previous studies investigated the digital skills for a citizen, a student, or a teacher, there is a lack of research on what digital skills are needed by the learners who wish to create and manage their own PLE [5, 12, 21].

This paper investigates this problem to identify the learner's required digital skills for PLE development and management. The next section 2 analyses the adopted research methodology, while section 3 presents the *Personal Learning Environment Model* (PeLEM) that describes how the learner collects and uses resources in order to build a PLE, and where these resources reside. Next section, describes the stages that the learner follows in order to collect, organize, use, and share resources in the PLE. Then, section 5 describes the digital skills needed in order to develop and manage a PLE. Finally, section 6 discusses the final conclusions and proposes recommendations for future research.

## 2 Methodology

With the aim to identify the learner's required digital skills for PLE development and management we first conducted a desktop literature review and on the basis of the critical analysis of the relevant literature we then organized two mini focus groups discussions.

In the literature review, our initial objective/scope was to establish a general understanding of the topic through a preliminary search in *Google Scholar* using specific keywords for the studies to be included. The second step of this literature review was to do a search also on *Scopus*. The electronic searches were done during April and May 2021. The following query string ("Personal Learning Environments" or PLE or PLEs) and ("Digital Skills" or "Digital Competence" or "Digital Literacy" or "ICT Skills" or "ICT Literacy") was used to search the titles of articles in *Google Scholar* as well as the titles, abstracts and keywords of documents in *Scopus*. The results were four (4) articles in *Google Scholar* and thirty-four (34) articles in *Scopus*. Next, a set of inclusion and exclusion criteria were employed for facilitating the selection of relevant articles.

### A. Inclusion Criteria

The following inclusion criteria were used:

1. Article presents "Digital Skills" or "Digital Competence" or "Digital Literacy" or "ICT Skills" or "ICT Literacy" for PLEs;
2. Article presents sufficient data to identify how "Digital Skills" or "Digital Competence" or "Digital Literacy" or "ICT Skills" or "ICT Literacy" are used in developing PLEs;
3. Article is peer-reviewed;
4. Article is written in English.

### B. Exclusion Criteria

The following exclusion criteria were used:

1. Article refers to the impact of "Digital Skills" or "Digital Competence" or "Digital Literacy" or "ICT Skills" or "ICT Literacy" on PLE usage;
2. Article refers to the impact of PLE usage on person's "Digital Skills" or "Digital Competence" or "Digital Literacy" or "ICT Skills" or "ICT Literacy";
3. Article does not provide sufficient information on the person's "Digital Skills" or "Digital Competence" or "Digital Literacy" or "ICT Skills" or "ICT Literacy";
4. Article is written in language other than English.

The findings have shown that there is quite poor research on what digital skills are needed by the learners who wish to create and manage their own PLE as aforementioned. In fact, the results revealed that there was not any article which met all the above criteria.

In the focus groups, we aimed at collecting users' perceptions, needs and experiences in developing and managing their PLEs. In order to enrich and support further our research, we organized also two (2) mini focus groups discussions

of 4 participants in each one. Focus groups constitute a research method that researchers organize for the purpose of collecting qualitative data, through interactive and directed discussions [36]. Even though focus groups typically are conducted face-to-face, due to the pandemic crisis we preferred to organize them online as this mode of conducting qualitative research is well accepted during the last years with the advent of new technologies. The type of the focus group discussions adopted was the synchronous one. In the first live discussion university students participated, while in the second one the participants were researchers. We adopted a specific guideline [37, 38] on how to conduct focus-group online discussions that included criteria such as the homogeneity of the group, relaxing atmosphere created by the moderator, support by the note taker, video recording, use of a list of questions and specific discussion topics, etc. The discussion in each mini focus group lasted 45 minutes. The first author acted as the moderator and the second author as the observer and note-taker.

Initially, the focus groups' participants were introduced to the concept of PLE and the purpose of the focus group discussion. Then the following questions triggered discussions among the participants:

- How do you find educational resources? Please describe the steps and give examples.
- What skills do you need in order to find educational resources?
- How do you develop your PLE? Please describe the steps and give examples.
- What skills do you need in order to develop your PLE?
- How do you manage and use your PLE? Please describe the steps and give examples.
- What skills do you need in order to manage and use your PLE?
- How do you share educational resources? Please describe the steps and give examples.
- What skills do you need in order to share educational resources?
- How do you communicate and collaborate with others about educational resources? Please describe the steps and give examples.
- What skills do you need in order to communicate and collaborate with others?

The analysis of the collected data by the focus groups discussions has revealed the digital skills they need in order to develop efficiently their PLEs. For example, participants stated that they do the following:

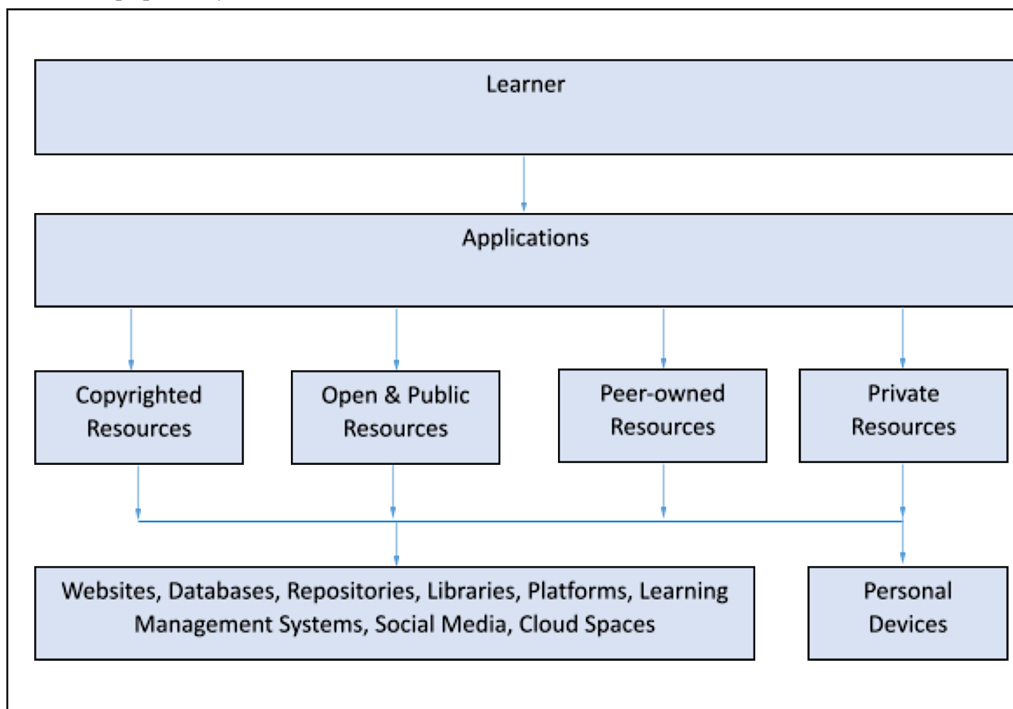
- Search for educational resources using search engines (e.g., Google, Google Scholar), repositories of open educational resources (e.g., Merlot, Open Textbook Library), courses in educational institutes (e.g., MIT OpenCourseWare, Open University's OpenLearn), educational resources in educational institutes (e.g., Libraries, Learning Management Systems), social media (e.g., YouTube, LinkedIn), MOOCs providers (e.g., Coursera, edX), national and international educational organizations (e.g., UNESCO, OECD, European Commission), databases of scientific publications (e.g., Research Gate, Academia, Web of Science, Scopus), publishers (e.g., IEEE, ACM, Springer, Taylor & Francis);
- Store educational resources in the cloud (e.g., Google Drive, Dropbox, iCloud, One Drive), databases of scientific publications (e.g., Research Gate, Academia);
- Create educational resources using presentation tools (e.g., MS Powerpoint, Google Slides, Prezi), multimedia authoring tools (e.g., Adobe Premier, Apple iMovie, YouTube Video Editor);
- Organize their educational resources in cloud services (e.g., Google Drive, Dropbox). For example, they Create Folders and Subfolders in Google Drive; Upload Files in Folders; Move Files between Folders; Sort Files in Folders; Set Sharing Permissions; Share Files and Folders;
- Organize research articles using reference management systems (e.g., Mendeley, Endnote, Zotero);
- Bookmark educational resources in bookmarking services (e.g., Diigo, Scoop.it, Reddit, Delicious), in their browser (e.g., Chrome, Safari, Internet Explorer);
- Create tables or spreadsheets to record and taxonomize personal resources for a particular subject using appropriate attributes (e.g., attributes for an articles' collection: year, citation, abstract, keywords, research questions, methodology, findings, pros, cons, results, future research);
- Schedule their tasks using calendars (e.g., Google Calendar, Apple Calendar), their meetings (e.g., Doodle);
- Share resources using social media (e.g., Facebook, LinkedIn, YouTube), scholarly networks (e.g., Research Gate, Academia), shared spaces (e.g., Google Drive, MS teams);

- Communicate and collaborate using email (e.g., Gmail, MS Outlook), messaging (e.g., WhatsApp, Viber, facebook messenger), mobile phones, videoconferencing (e.g., Zoom, Google Meet, Skype), digital collaboration tools (e.g., Padlet).

Both the literature review findings and the focus group inspired the design of the “PLE Model” (PeLEM) and “the cycle of the PLE development” which are presented and analyzed in the following sections.

### 3 PLE Model (PeLEM)

In order to identify the digital skills needed by a learner, we explored the set of actions taken by the learner in order to design and develop his/her own PLE. Initially, the learner should have access to a digital device (personal, peer-owned, institutional-owned, or public digital device) equipped with appropriate applications such as digital tools for searching, browsing, recording, editing & authoring, scheduling, communicating, collaborating, sharing, etc. Using the applications, the learner can have access to a variety of resources such as copyrighted, open & public, peer-owned and private resources (Figure 1). A resource can be data, information, link, text, article, book, presentation, photo, song, video, map, game, course, syllabus, bibliography, software, etc. A copyrighted resource is a resource that has copyrights but anyone can buy and use it. An open & public resource is a resource that is completely open or has some creative commons restrictions. A peer-owned resource is a resource that can be shared by a peer. Finally, a private resource is a resource that the learner keeps privately.



**Figure 1: Personal Learning Environment Model (PeLEM).**

These resources can be stored in public spaces or in the learner’s personal devices (e.g., desktop computer, laptop, tablet, smartphone, photo/video camera, wearable, game console, external hard disk, memory stick). Public spaces are spaces that are shared by many people. The public spaces’ hardware (e.g., servers, storage) is not under the complete control by the learner. These public spaces include websites, wikis, blogs, databases, repositories, libraries, platforms, learning management systems (LMS), folksonomies, social media, communities, virtual social worlds, cloud services and

more. These public spaces can be open to anyone, or only to a specific group of people (e.g., registered learners in a course have access to the course material in the LMS) or even the learner who can own some private space in them. So, the public spaces can contain completely open areas to all as well as password-protected areas.

For example, the learner searches a Repository of Open Educational Resources (ROER) using a browser via his/her smartphone. The learner locates an interesting OER and either bookmarks it or downloads it to his/her smartphone or to his/her private space in a cloud service or shares the OER's link via his/her social media account. In another example, the learner creates a video using a video editor in his/her laptop, uploads it in the class LMS and shares it with his/her peers via a cloud service. In these examples, the OER and the video become part of the learner's PLE.

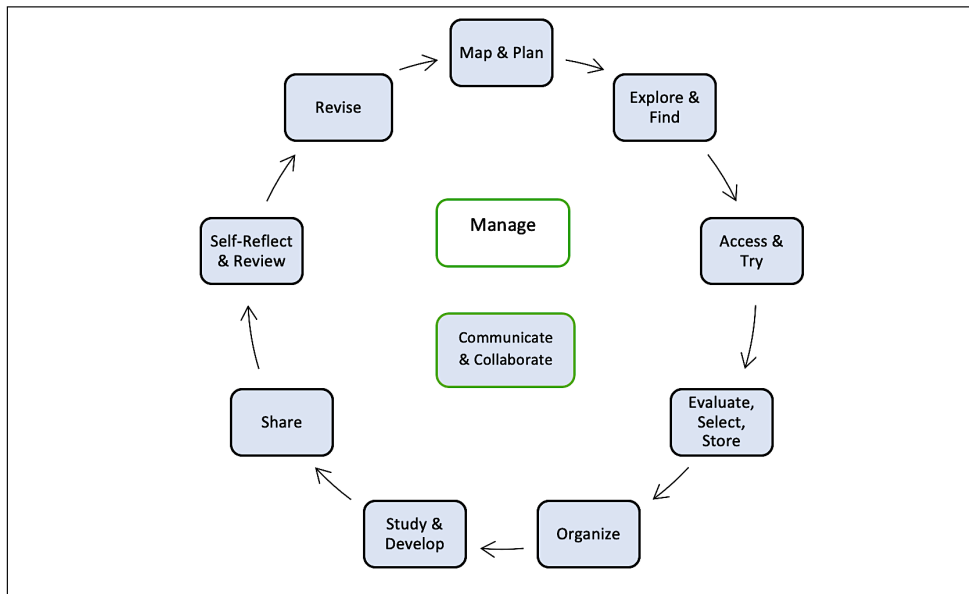
According to this Personal Learning Environment Model (PeLEM), the learner uses various applications via any digital device anywhere and anytime in order to access, store, organize, use, develop, and share resources (stored in private or public spaces) but also to communicate and collaborate with others in order to achieve his/her educational objectives. The learner has the control over all learning attributes (e.g., objectives, place, time, pace, scheduling, devices, media, resources, methods, collaborations, outcomes). The PLE includes the combined resources, applications, tools, methods, and collaborations that the learner exploits for learning. The PLE resources can be stored in the learner's personal devices or can be distributed to various public or private spaces. The next section analyzes further the stages for developing and managing PLE.

## **4 Stages in Developing & Managing a PLE**

A personal learning environment (PLE) enables a learner to manage his/her own learning including setting objectives, collecting and evaluating appropriate resources, planning, developing, managing and sharing resources, communicating and collaborating with learners, teachers and experts, self-reflecting and self-assessing as well as revising all in order to achieve his/her own objectives.

Therefore, in order to develop and manage a PLE, the learner repeatedly follows the following stages: 1) Map & Plan, 2) Explore & Find, 3) Access & Try, 4) Evaluate, Select & Store, 4) Organize, 5) Study & Develop, 6) Share, 7) Self-Reflect & Review, 8) Revise (Figure 2). The learner takes control of his/her learning (what, where, when, why, how, with whom) adapting the learning process, methods, resources, tools, collaborators (e.g., teachers, peers, experts) and other ingredients of learning to his/her personal characteristics (e.g., goals, needs, preferences, knowledge, abilities, skills, attitudes, wills, emotions, strategies, methods, connections, relationships, collaborations, etc.). PLE's Management as well as Communication & Collaboration with others occur at every stage of the cycle. For example, the learner may collaborate with peers in order to evaluate a set of resources. The learner acts both autonomously and collaboratively.

Initially, the learner defines his/her own learning objectives, identifies and maps the available resources, tools, infrastructure, peers and collaborators. Then, the learner explores the public and private spaces in order to find interesting resources to use. After accessing and trying (watching, reading, listening, etc.) the resources, the learner evaluates them, and selects and stores the most appropriate ones for his/her own learning purposes. Next, the learner organizes the selected resources for learning while in the following stage, the learner studies the chosen resources and may develop new resources. Also, the learner communicates and collaborates with others as well as shares resources. Then, the learner self-reflects on all previous stages and reviews them as well. Finally, the learner revises all actions taken in all stages and repeats the cycle from the beginning. Learning takes place at every stage of this personal learning process cycle.



**Figure 2: The cycle of the PLE development.**

## 5 Required PLE Digital Skills

In order the learner to effectively implement every stage in developing and managing his/her PLE, he/she should have appropriate digital skills. Therefore, the learner should be able to:

- define his/her learning needs, preferences, and objectives, to identify the available resources, tools, infrastructure, peers and collaborators, to design a plan, and to schedule the process in order to satisfy his/her learning objectives.
- use search engines, and explore repositories and databases in order to find useful resources for achieving his/her objectives.
- access and try (watch, read, listen, etc.) the identified resources using digital tools.
- evaluate the identified resources using specific criteria (e.g., authenticity, credibility, quality, timeliness, usefulness), select the most appropriate resources and store them to suitable local or decentralized spaces using digital tools.
- organize the resources using digital tools for curating, taxonomizing, cataloguing, tagging, bookmarking, referencing, and annotating them.
- study the resources, modify and adapt them, and develop new resources using authoring tools (e.g., text, presentation, spreadsheet, graph, photo, audio, video, blog, wiki, website editors).
- share resources using digital distribution and sharing tools.
- communicate with others using communication tools such as email, messaging, conferencing.
- collaborate with others using collaboration platforms, cloud services, LMS, forms, social media, wikis, scheduling meetings, etc.
- manage the resources, tools, infrastructure, peers and collaborators using digital tools for project management, time management, calendar, scheduling, security and protection (e.g., antivirus, passwords, privacy), as well as for copyrights management of the resources.

Mastering all the above digital skills the learner can effectively develop and manage his/her her PLE.

Usually, in traditional education (no self-regulated learning), the teacher finds, selects, develops, organizes etc. the educational resources. So, the learner does not need to have all corresponding digital skills. On the other hand, in PLE, the learner takes control of his/her own learning. Therefore, the learner should have all proposed PLE digital skills.

Furthermore, both in formal and informal & nonformal education, the learner usually does not preserve educational resources for later use. On the other hand, PLE refers to a concrete and finite personal learning space (physical and/or virtual). The learner curates, organizes, and manages educational resources to satisfy specific personal learning objectives. Therefore, the learner should have all proposed PLE digital skills and especially digital skills for curating, taxonomizing, cataloguing, tagging, bookmarking, referencing, and annotating educational resources. The learner should be able to curate, organize, and manage the educational resources so that he/she can access, study, use, and share them any time later.

## 6 Conclusions and Future Research

PLEs would support the learner in his/her continuous lifelong learning. A PLE enables the learner to take control of what, where, when, how, why, with whom he/she will learn in order to realize his/her objectives. Initially, the paper introduces the PeLEM model which describes how the user uses applications to access and manage resources in order to develop his/her own PLE. Using various applications via any device (mobile or not, private or not), the learner collects, manages and stores various resources in public or private spaces in order to develop his/her PLE. Then the paper describes the stages that the learner follows in order to collect, manage, develop, and share resources as well as communicate and collaborate with others (e.g., colleagues, teachers, experts) in his/her own PLE. In order to effectively implement each stage, the learner should have the appropriate digital skills.

Future research would investigate learners across various educational levels, subjects, and countries in order to identify the levels of their digital skills for developing and managing their PLE. It would also examine if there are differences among them with respect to their age, gender, personal characteristics, educational level, subject, country and other variables.

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