

# Designing and Implementing PLEs in a Secondary School Using Web2.0 Tools

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**Abstract** Although current and upcoming web technologies offer all kinds of new opportunities to support student-centered learning, there does not exist yet a clear roadmap to integrate these technologies into teaching and learning processes. In this paper a model is introduced in order to develop Personal Learning Environments (PLEs) consisting of Web2.0 tools and to integrate them into teaching and learning processes. Next to this, an example implementation in the context of a secondary school is described. Two questions framed this study. First, how do students integrate PLE tools into their learning activities? Second, what is the students and teacher's perception of the PLE project? Results show, among others, that web2.0 tools should be thoroughly integrated with active teaching and learning methods in order to realize a student-centered learning environment. It was also concluded that students need enough time and teacher's facilitation in order to get learning and pedagogical value out of PLEs tools and to be able to truly integrate them into their learning activities.

**Keywords:** Personal learning environments, Web2.0, Active teaching and learning, Student-centered learning environment

## 1 Introduction

Educational systems should mirror and support the values and priorities of an increasingly technological society and knowledge intensive era, and prepare students to live and act in a rapidly changing world [1], [10]. In order to cope with the needs and challenges of the new knowledge landscape, a radical revision of traditional pedagogical approaches, principles, and policies imposed by formal educational institutions is required [2], [3], [6], and [10].

Technology is a key driver for educational changes [3], [11]. Research findings indicate that the environment in which students are working is complex and multifaceted. Technology is at the heart of all aspects of their lives [13]. The role of technology can be viewed in several ways here: as a collection of tools to support knowledge construction, as an information vehicle for exploring knowledge to support learning, as a context to support learning by doing, as a social medium to support learning by conversing, and as an intellectual partner to support higher order thinking skills through mindful engagement and learning by reflecting [5], [10], [12].

In practice, existing and emergent Web2.0 technologies offer (new) opportunities for students to find and use rich sources of information, to connect to more capable people [8] outside of the class boundaries, and to analyze and synthesize information and knowledge. These technologies can enable students to have more control over their learning and can support them to become active, self-directed, and autonomous learners [5], [6].

The personal learning environment (PLE) concerns a new model of technology-enhanced learning that supports learner-centered approaches by allowing learners to create and develop customized learning environment with Web 2.0 technologies. “A PLE is a learner’s gate to knowledge.” [6]. Often the PLE is considered as a more natural and learner-centric model to learning that takes a small pieces, loosely joined approach, characterized by the freeform use of a set of learner-controlled tools and the bottom-up creation of knowledge ecologies [6], [11].

Understanding the potential benefits of PLEs, the question remains how they should be designed and deployed in order to support heterogeneous learning demands on new generation of learners. In this paper, a technology-enhanced, student-centered learning framework is introduced. This framework offers a model to incorporate PLE building into teaching and learning processes.

The remainder in this paper is structured as follows. In section 2, we provide the theoretical background of the proposed framework based on a review of related work. Next, in section 3, we introduce the new framework and describe its characteristics. In section 4, we explain research context, research design, and implementation of PLEs. Next, in section 5, the results of this research are explained. In section 6, we discuss our results. In section 7, we conclude and provide a short outlook towards future research.

## 2 Literature Review

A literature review taught us that the philosophy of constructivism provides a sound theoretical basis for our framework. Within constructivism, the main responsibility of learning should reside in the learners. This means that the learners should behave as active agents during the learning process by constructing their own knowledge and understanding, not by only mirroring and reflecting what they read [9]. Constructivist-inspired learning environments often provide resources for learners to manage their own learning through exploration, hypothesis formation, and student-relevant feedback. Knowledge is constructed while individuals engage activities, receive and provide feedback, and participate in multiple forms of interaction [11]. “Learning by creating and developing a PLE follows a constructivism approach to learning” [5]. Students learn through the process of applying technology with the goal of constructing a customized learning environment [5], [10].

The networked student model [5] has inspired this study. Networked students are “equipped with appropriate information management skills, Web2.0 technologies, and social contacts (i.e. coworkers, family, friends, classmates, teachers, experts) to build their own PLE and apply it to accomplish learning activities, deal with complexity and diversity of digital content”, connect to more capable people [8], play an active role during learning process, and take control over their own learning [5].

Three dimensions can be identified to characterize a technology-enhanced learning environment: “the macrocontext that contains systemic reform and educational standards; the teacher community which includes physical or virtual context, where teachers share expertise and mentor each other; and the microcontext, which includes classroom context, where learning and teaching occurs”. [12] The interactions among the standards, teacher community, and classroom contexts are key to exploring the role of technologies and it is not the innovative technologies per se that have an impact on students’ learning, but, instead, the interactive and iterative learning environments [12].

### 3 A Framework for Constructing PLEs

Having sketched the theoretical context, the way has been prepared to introduce the new general framework and its characteristics. “Fig. 1” depicts the framework for constructing PLE-based student-centric learning environments. It is based on adapted versions of the networked student model [5] and the technology-enhanced teaching and learning model [12]. It is further assumed that knowledge is socially constructed, (i.e., that learning is fundamentally social in nature and resides in networks [20]), and that each student is owner of his (her) own learning. Based on these assumptions, the framework identifies and proposes contexts at school, and classroom levels that influence the teaching and learning activities within a student-centered PLE. We continue by describing these contexts in much more detail.

#### 3.1 School Context

In our framework, the factors within the school boundaries that influence the design of learning environments are categorized as follows:

**Management Support.** Without willingness and active engagement of school’s administrators, implementing a technology-enhanced student-centered learning environment is very difficult. Administrators’ support is crucial to provide sufficient technological infrastructure, to define and enact necessary policy and rules, to motivate and support teachers and students, and to provide appropriate professional development for teachers.

**Technological Issues.** Technological issues and requirements include: providing sufficient technological infrastructure; providing sufficient access to Internet and web resources for students; enacting policies and rules to employ technology, efficiently and safely.

#### 3.2 Classroom Context

The classroom context where students build their PLEs with Web 2.0 tools and resources is the central part of the framework and includes the following components:

**Instructional Model:** Our framework uses the Learning Cycle model as the instructional model. This inquiry-based model provides the active learning experiences based

on constructivism as its theoretical foundation [17]. The learning cycle follows Bybee's model in [16] and includes the five "E" steps of engagement, exploration, explanation, elaboration, and evaluation. The learning cycle begins with the active engagement of students in the learning's topic. In the exploration step, the teacher orchestrates a discussion period in which students share their observations with their classmates. Once the concept has been labeled, students engage in additional activities in which they apply their recently formed understandings to new situations [19]. It is a cyclic process with no end. After the elaboration ends by teacher, the engagement of the next learning cycle begins. Evaluation is not the last step and occurs in all four parts of the learning cycle.

**Learning Objectives.** Learning objectives define new knowledge, capabilities, and skills the students will gain, and tangible outcomes they have to deliver or present at the end of their learning. Although students, in a student-centered learning environment should be able to define and select their learning objectives, they may also follow the learning objectives as defined by the teacher [7]. It is important to share learning goals with students, receive their feedback, and engage them in order to define mechanisms for fixing learning goals.

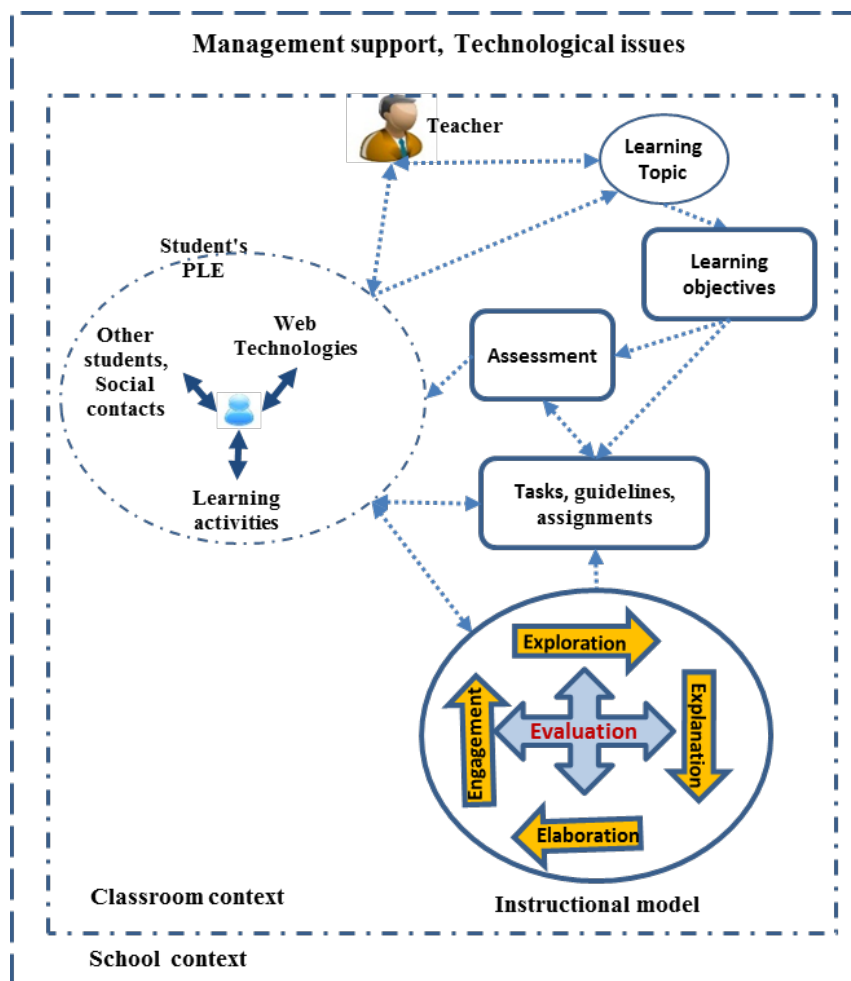
**Assessment and Evaluation.** At the end of each step of learning cycle, students will be assessed and evaluated on how they achieved the defined learning goals for associated step or learning's topic. The assessment focuses on learning process and outcomes of the learning process. In our framework, methods used for the process assessment and evaluation include peer evaluation, e-portfolio, writing online reflecting journal [21], written essay, weekly assignment [5], and collaboration pattern. In a PLE-based learning, product assessment aims to investigate the quality of the final outcomes which includes rubric-based assessment of PLEs, the number and quality of widgets or gadgets in personal page, weblog writing, the number of written comments on other students' blogs, and the quality of the final project [5].

**Web Technologies, Learning Activities, and Social Contacts.** To achieve the learning objectives, appropriate elements of Web technologies, learning activities (e.g. group Storytelling, mind mapping or Brain storming), and social contacts (i.e. coworkers, family, friends, classmates, teachers, experts) need to be integrated into students' PLEs.

**Tasks, Guidelines, Assignments.** PLE-based learning is a new experience for many of students [5]. Therefore, they need to be supported by teachers in order to learn how to develop their own PLEs and to deploy them to support learning activities. In each step of the learning cycle, appropriate guidelines, tasks, and assignments should be defined by the teacher to instruct students how to build and use their PLEs. These guidelines and tasks are supposed to incorporate technology into the learning's topic. In the beginning, students may need to rely heavily on these guidelines. When time passes, they will learn to act more independently [5]. The defined guidelines, tasks, and assignments should address the following attributes:

- Orchestrate all students' activities around a topic;

- Explain the expectations and assessment criteria clearly;
- Promote self-expression by encouraging students to create and share personal voice and knowledge;
- Promote students' critical thinking and other higher-order thinking;
- Provide opportunities for students to take control over content, pace, sequence, and learning process;
- Promote collaboration and team working;
- Highlight features of technology which can support the learning process;
- Connect the current step to the next step in the learning cycle.



**Fig. 1.** A pedagogical-technological framework for developing PLEs and integrating them into the teaching and learning process

**A Model to Integrate PLE Building into Teaching and Learning Process.** Our framework adapts a model for ICT integration in classroom as proposed in [21] to de-

velop a model, Fig. 2, that provides a systematic procedure for designing learning activities by integrating and rounding different elements of the framework.

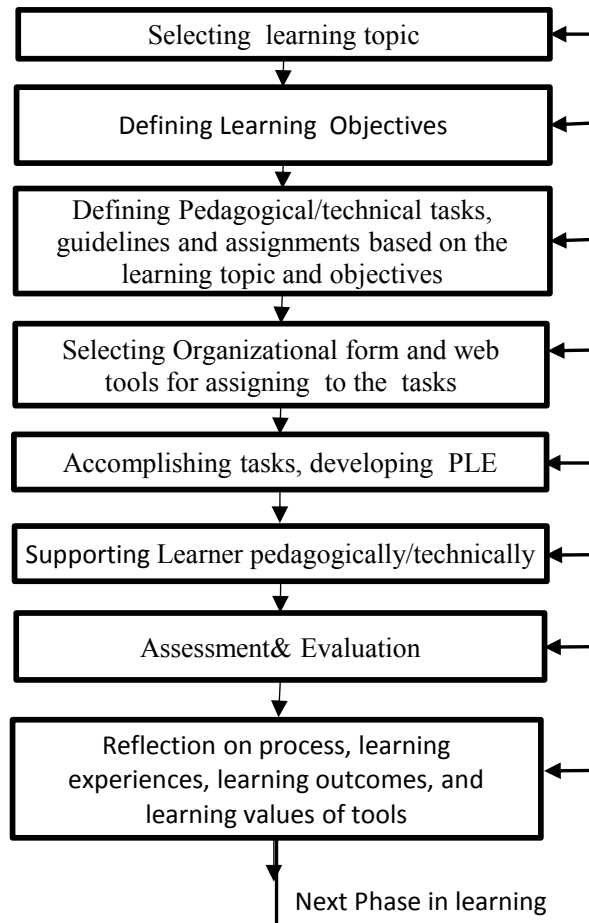


Fig. 2. A model to integrate PLE building into teaching and learning process

The above-given description completes our proposal for a pedagogical-technological framework to develop technology-enhanced, student-centered PLEs. While describing its components, which include the various contexts that are supposed to be of crucial importance for successfully creating and deploying PLEs, we have tried to be as complete as possible. The next parts of paper describe an attempt to applying this framework in a secondary school willing to pioneer in this field.

## 4 Project Description

### 4.1 Research Context

Amadeus Lyceum is an innovative secondary school in the Netherlands. Culture and art are the important subjects being taught in this school. Amadeus has chosen four

core values that constitute the basis of its educational system. These core values are: personal development, self-expression, creativity, and dialogue. Shifting from a “one size-fits all” approach towards individualized curricula is one of the educational goals of this school [23].

Amadeus has been using a Moodle-based CMS to store and retrieve course materials and assignments. The school has launched a new electronic learning environment with more functionality for teachers and students to work around the courses content. It provides a part for teachers to upload courses’ material and to define assignments, and a part for students in which they can upload relevant content. The main challenge of this new learning environment is to make it a walled-garden, i.e., an internal-oriented and top-down course management system without enough functionality and flexibility (a) to support emergent and heterogeneous learning requirements of students and (b) to allow them to use their favorite learning tools and resource.

The learner-centric approach of PLEs suggests that PLEs can be used to design technology-based and learner-centered pedagogies to fulfill the emergent and heterogeneous educational needs of Amadeus students. To introduce the PLE concept and to realize how PLEs can be integrated into the school context to support learning activities of students, this design-based research has been carried out in order to address the following research questions:

- How do students use the Web to support their learning/non-learning activities?
- How do students integrate PLE tools into their learning activities?
- What is the students and teacher’s perception of the PLE project?

#### **4.2 Research Design**

The research was conducted in a first year class of the aforementioned secondary school, consisting of 30 students of 12-13 years old. Related to their geography and society course, students were asked to design and develop a digital travelling guide for Egypt during the 5-weeks period of the project. Students were grouped in five-student teams and each group was asked to develop a separate travelling guide. In order to stimulate students to actively participate in project, no any pre-defined and recommended structure for the travelling guide was defined by the teacher. The students in each group were asked to think in group about the structure of travelling guide and to select an appropriate digital media to present it. To provoke their responsibility regarding to use of technology and to practice digital responsibility skills, all of the involved students in the project, were provided with extended access to Internet via their own laptop.

The design process was running smoothly based on close collaboration between the research team, associated teacher, and school administrators’ representative. The design team held one meeting per week to design required learning tasks for the next week and to review and evaluate the process of the project.

**Used Web Tools.** The following list of web tools was selected and introduced to students to support their learning activities and to develop their PLEs. These tools were selected based on prior experience of the teacher with tools, appropriateness to the defined learning objectives, and technological affordances of the school. Initially, students were not familiar with most of these tools. Therefore, the first week of the pro-

ject was devoted to introduce these tools to the students. A fun approach was followed to introduce tools. For example, for introducing Blog, students were asked to write an English joke as their first blog's post, and for introducing iGoogle, students were asked to create a tab, entitled FUNTAB and add some funny gadgets in it.

**Table 1.** Used web tools to develop students' PLEs

Tool	Purpose
iGoogle	Personal Start Page
MindMeister	Mind mapping
Google Docs	Document creating and sharing
Google Sites	Project wiki, students websites
WordPress and Blogger	Blogging
Twitter	Micro blogging
Prezi	Presentation
Free website building and hosting tools	Create final traveling guide
YouTube	Video Content

**Data Gathering and Analysis.** To collect data a mixed approach, consisting qualitative and quantitative methods, has been used [22]. First, qualitative methods including group interviews with students, interviews with teacher and school administrators, direct observation of students working in classroom, and analysis of the content created by students during the project were employed to explore the fieldwork. The collected data were coded and categorized into several classes. Next, a questionnaire contained several questions associated with these categories, derived from the collected data and literature, was distributed among the students.

## 5 Results

**Question1.** How do students use web to support their learning/non-learning activities?

**Findings.** The main objective of this question was to realize some contextual information about the prior experiences of students in working with web tools for supporting their learning/non-learning activities. To address this question, the answers of students to associated questions were classified (Table 2) by using the categories proposed in [4].

According to Fig. 3, prior web experiences of students are mainly about using the standard web tools for searching information, access to school's CMS, gaming, sending and reading email. Their use of web2.0 tools is mainly focused on social networking with Facebook or Hyves (a Dutch social networking platform) and working with Twitter. None of them was familiar with any social bookmarking tool, RSS readers or worked with web discussing (e.g. writing to a discussion board or Forum, Commenting on someone else's blog).



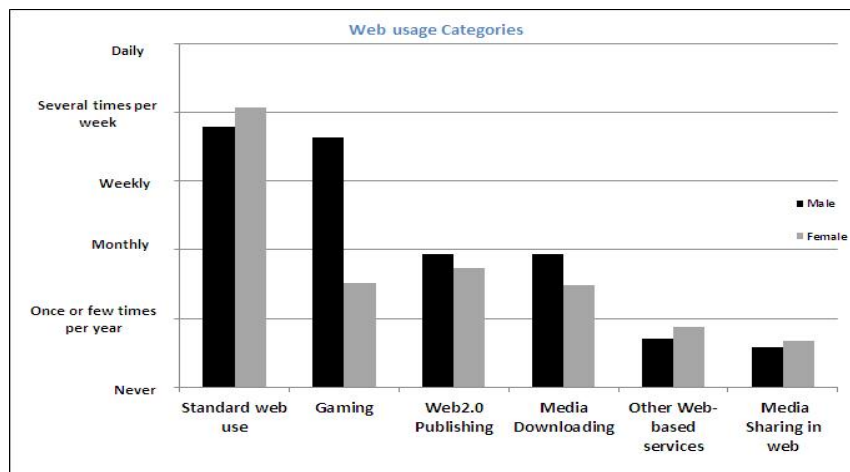
**Table 2.** Web usage categories

Web usage category	Included items
Standard Web use	Using the School's course management system, Searching the web by search engines, Sending and reading Email, Chatting, Using the school web site
Gaming	Online Computer Games, and virtual worlds
Web2.0 Publishing	Social networking( Facebook, Hyves, etc.), Micro blogging (Twitter, etc.), Web Discussing: writing to an discussion board or Forum, Commenting on someone else's blog post, Writing, reading, or Editing wikis, blogs, or Wikipedia
Media Downloading	Watching TV/Video clips online, Listening to online radio, Downloading different type of media
Other Web-based services	Shopping: buy something online,
Media Sharing in web	Finding a Web site or gadget related to your course topics, Introduce a new website or gadget to your friends, Using Google reader or any RSS reader, Social bookmarking/tagging(Diigo, del.ici.ous), Uploading to share: a photo, video, music, or other sort of files created by user

**Question 2.** How do students integrate PLE into their learning activities?

**Finding.** Students accomplished several learning activities during the project. The following four themes have emerged through their learning activities:

- Dealing with tools to support learning activities
- Collaborative learning
- Practicing higher order thinking skills
- Taking control and responsibility over learning

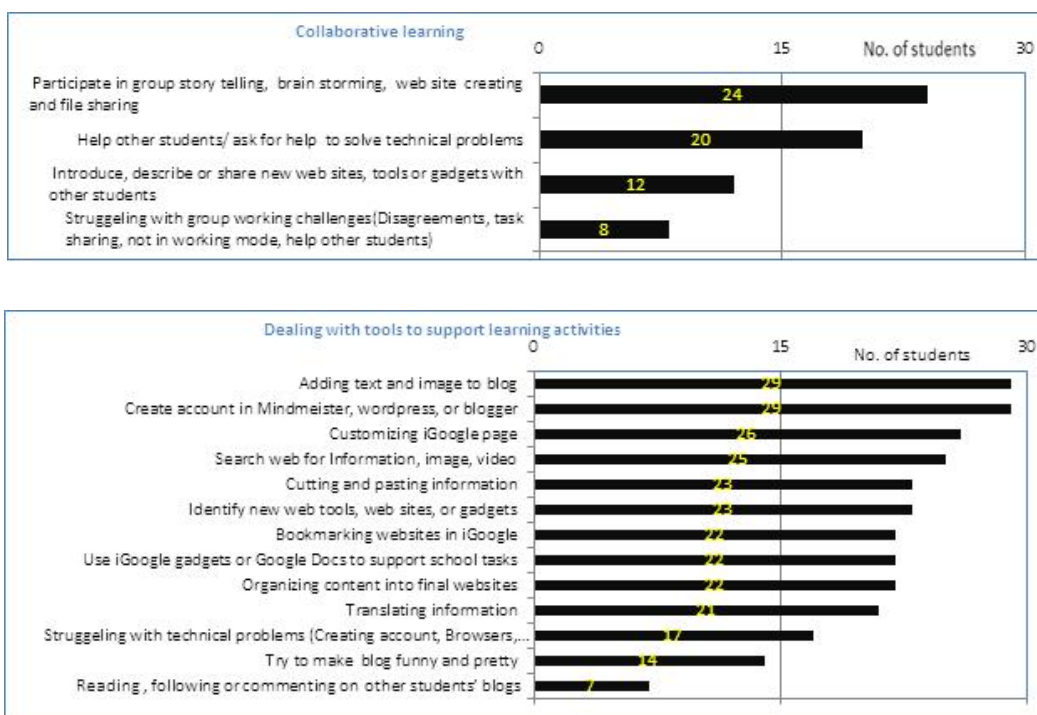


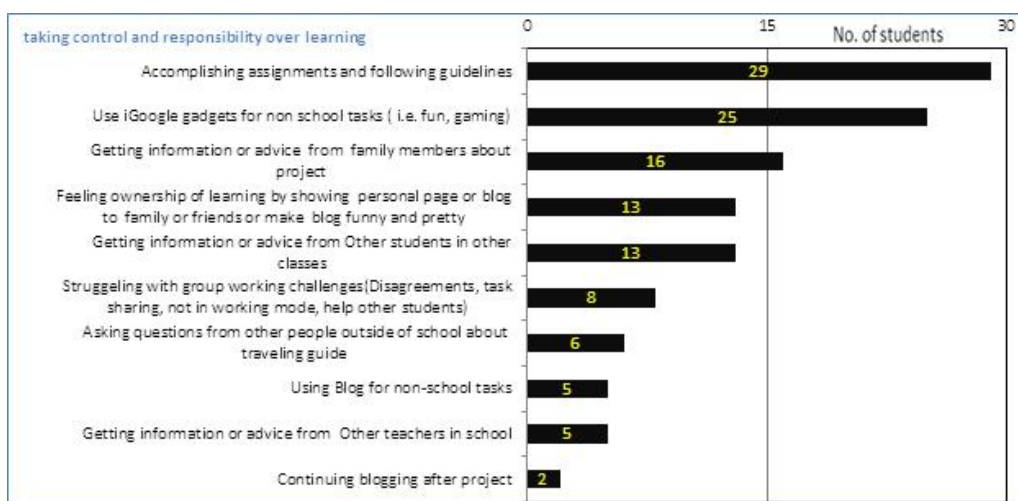
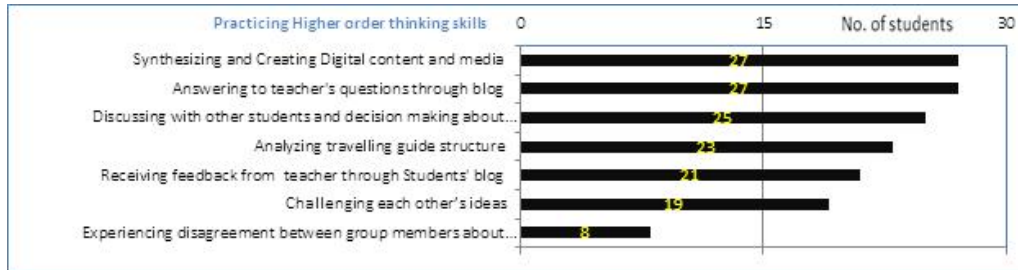
**Fig. 3.** Prior web experiences of the students

Whereas the activities' pattern shows that students, mainly, have followed the tasks and assignments instructed by the teacher, there is evidence as well for conducting some forms of informal and self-directed learning such as: asking question from social contacts outside of class; reading, following or commenting on each other blogs; using blog for non-school tasks; and continuing blogging after the project. Because a separate preparation phase was not planned before the project for introducing tools, creating account, and configuring tools, students have faced and struggled with a lot of technical problems to create an account for the selected tools during the first week of project. Sometimes, these technical problems were so stressful for teacher and students that it led to students' unsatisfaction.

During the project, students were using the Internet and the introduced web tools not merely for learning purposes. They were busy during the first and second week of the project to explore fun aspects of the introduced tools. Nearly all have played games by using iGoogle gadgets. The teacher has adopted a persuasive approach to negotiate about the learning value of a game with students at times he witnessed students gaming with the selected tools in the classroom.

**Table 3.** Accomplished activities by students during the PLE project





**Question 3.** What are the students' and teachers' perceptions about the PLE project?

**Finding.** Fig. 4. shows how the PLE-based learning has been perceived by the students.

The results suggest that students have recognized the personal benefits (i.e. having full access to Internet, feeling ownership) of web tools more than their pedagogical benefits. Surprisingly, whereas there is less agreement between students about the positive impact of PLE-based learning on understanding of course content, the full access to Internet during the project and taking control and responsibility over the learning process are the most favorite aspects of the PLE project, as perceived by the students.

During the project, the teacher and students struggled with technical problems, group working issues and the challenges raised by defining new teaching and learning processes. Covering the academic content of the course was not more emphasized by the teacher. During interview with the teacher he stated: "I believe that in this project the method or process of the project was more important than the content and quality of the final outcome, so it was not so crucial to put more emphasize on content. In their final websites, students were busy more with look and feels and visual aspects of websites than content. So they developed very nice and beautiful websites with less qualitative content within". Indeed when an educational innovation is introduced to classroom setting which requires to manage complex skills, "students first work to-

ward a process goal perfecting the form or procedure that the skills involves without regard to the final outcome, then shifting attention to the product goal once the procedure is more automatized.” (Omrod, 2008, p. 526, cited in [15]).

In all items about one third of students have selected neutral option to state their perception about the raised aspects of the PLE project. Short duration of the project and limited number of course sessions per week (2 sessions per week) were stated as the main reasons for selecting this neutral standpoint, during interview with students and teachers.

One of the interesting results in this study is related to students’ perception about the distraction by technology or peers. According to this graph, one third of the students stated that PLE-based learning can lead to students’ distraction by technology or peers. Job sharing and group coordination were mentioned as faced problems in the PLE project, during the interview with students. This was first technology-based group working experience for most of them and they have been distracted by a student who was not in working mode, difficulty in task sharing, and group coordination. Technology was another source of students’ distraction. Technical distraction mainly caused by occurred problems during setting up of web tools, i.e. creating MindMeister account, or incompatibility between a web tool’s configurations and Microsoft windows as the default operating system of school.

Having full access to Internet during the project was interesting for the students and, simultaneously, a main concern for school administrators. One of the students explained their perception about it as below:

“When the degree of freedom to access to Internet or in your learning activities increases, you feel you have more independency and responsibility and you feel yourself as a person that owns his work. At the beginning, I might take pleasure of this free access to Internet for fun, but after a while I will use it for my learning”.

Concerns of school administrators about providing full access to Internet for the students is explained by one of the school administrators, involved in this project, as below:

“Possible abuses of Internet freedom like gaming, seeking porno images, and hacking the system make some sort of concerns for school managers. Indeed, using the Internet for gaming, porno, or other outside-of-learning border is like late coming to school. In late coming we will show a restrictive reaction, so here for abusing of Internet, the same approach is necessary. Otherwise this abusing behavior might be spread and unmanageable. It is an important question for school managers, how much freedom in Internet access should be allowed and is sufficient for 12 years old students”.

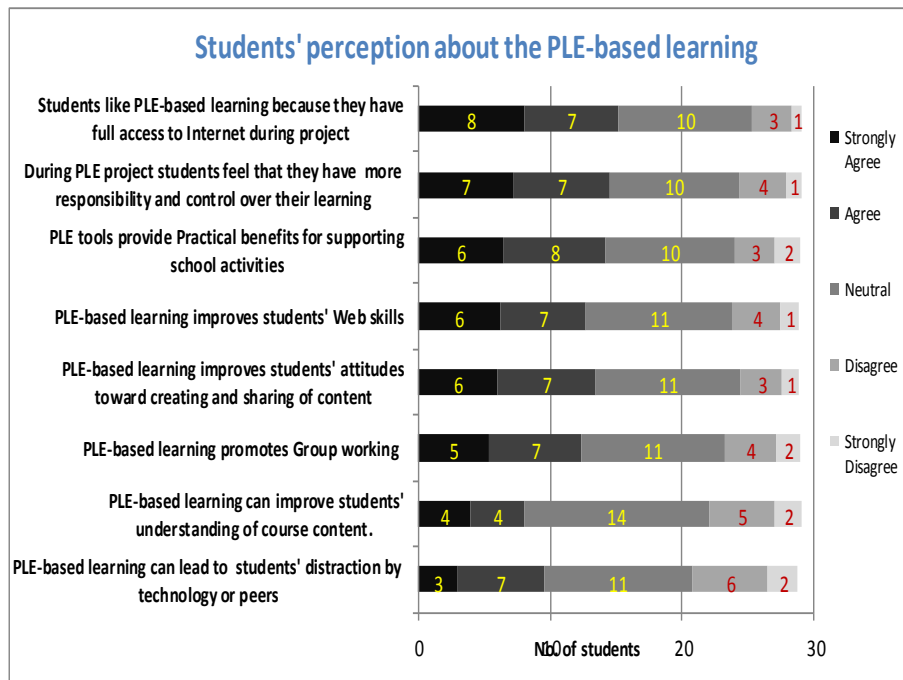


Fig. 4. A summary of students' perceptions about impacts of the PLE project on their learning

The PLE project was perceived by the teacher as a means to promote collaborative learning among the students, when he stated his viewpoint about possible benefits of PLE-based learning:

“Great collaboration, deep brain storming, and better and complex mind map. For example to help them to create a traveling guide mind map I provided a default and simple mind map for them, and you can see that their mind maps is really great and very complex. It is a result of real group working.

I think MindMeister is very useful tool for students and also for teachers. Compared to paper, in MindMeister you can add much digital stuff to your mind map including images, URLs, and links.”

Another teacher describes PLE not simply as some web tools, but as a means to promote a scientific research process and as a change in the way that students learn.

“They already are learning how to do research and they are following a scientific process. It seems that a PLE is not only introducing some tools for students. By using a PLE everything has to be changed, like assignments, teacher's behavior, and students' behavior.”

## 6 Discussion

There are several factors that influence the adoption and integration of PLE concept into teaching and learning process. First and foremost, students need teacher support and facilitation to realize learning benefits of web tools and to integrate them into their

learning activities. Web2.0 technologies, unlike LMS or CMS, are not ready-to-use learning tools. They provide some potential for learning and although students might be familiar with some technological and non-learning aspects of these tools, they are not more aware of pedagogical benefits of them. They need teacher's help and guidance to realize learning value of these tools and to tailor them to their heterogeneous learning requirements. Furthermore, many of secondary school students don't have prior technology-based group working experience. They need teacher support and facilitation to resolve faced group working problems.

Secondly, the ultimate objective of PLE-based learning is to give the control and responsibility over learning to students and to promote self-directed learning. Assuming PLEs solely as introducing some separate web tools to educational setting per se can't lead to a persistent active learning and self-directed learning.

Indeed, PLE tools should be positioned within a learning process comprised of active teaching and learning methods, like group brainstorming; collaborative storytelling; peer teaching; and group decision making, to integrate with them and to support underlying learning needs. A web tool to be adopted by students as a part of their PLEs in short term should, primarily, support their daily demands and activities while considering underpinning long term needs. In the conducted research, students were less inclined to use Blog than Google Docs because Google Docs helps student to work on the same document without sitting around a single computer and it was fun for them to do a collaborative storytelling, whereas using Blog as a learning tool didn't make sense for them in a short time.

Thirdly, where the introduction of technology in learning involves providing students with greater autonomy, this commonly conflicts with students and teachers' past educational experiences and requires a shift in their conceptions of what learning involves and what constitutes appropriate roles of students and teachers [18]. This shift will not happen spontaneously and rapidly and merely by introducing technology to educational setting. Involving students in learning design processes, delegating more control to students over their learning activities, employing active teaching and learning methods, employing technology to extend the contextual, physical and temporal borders of learning, and stimulating students to reflect on learning process can gradually construct teachers and students' perception about student-centered learning.

## **7 Learnt Lessons and Conclusion**

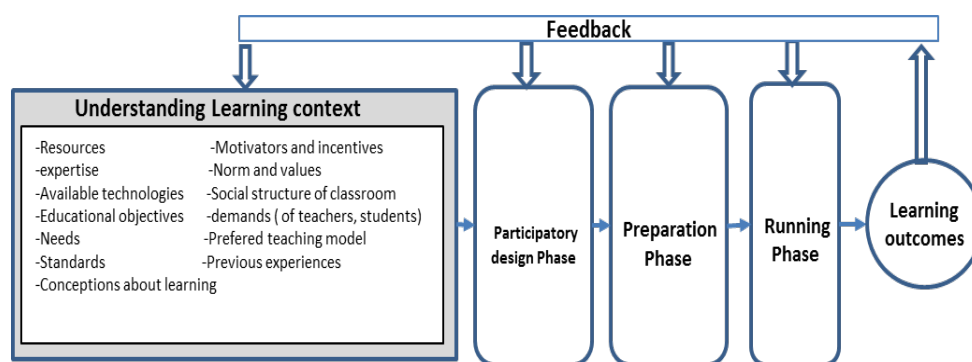
This research taught us the following lessons which should be considered to extend next phases of PLE-based learning environment:

- Don't overestimate digital capabilities of students. They need preparation to be able to tailor web tools to their learning needs and activities.
- Don't overwhelm students with introducing a lot of web tools in short time.
- Involve students in the learning design process by allowing them to decide about their favorite learning activities or to select their favorite web tools.
- Explain the expected role of teacher and students in a student-centered learning environment.

- Clarify the considered values in a PLE-based learning environment (i.e. sharing of knowledge and learning resource, collaboration, improving digital identity, knowledge construction, and so forth) to students.
- Emphasize on the whole learning process, not only on the final outcomes in the assessment rubric.
- Put more time, effort and facilitation to increase integration of PLE into learning activities.
- Consider contextual information of the class (i.e. demands, prior experiences, technological issues, students' motivators and incentives, expertise, and so forth) for designing PLE-based learning environments.

This research shows that PLE-based learning can promote students to get engaged in technology-supported learning activities; students need support and time to realize the learning value of web tools, and to adopt and integrate them into their learning activities. PLE-based learning is context-based learning. Understanding the contextual information of the educational setting, teachers and students is crucial for implementing a learner-centric learning environment. It is important to involve the students in a participatory design phase in order to design appropriate and personal learning activities by using selected web tools. It helps students to be informed about technological and pedagogical value of the web tools.

Based on the experiences and feedbacks elicited from the first phase of the PLE project, the diagram depicted in Fig. 5 is proposed to design and implement a PLE-based learning environment. The running phase of this diagram is identical to the proposed framework in fig1. Further research is required to evaluate and improve this model.



**Fig. 5.** Different phases for designing and implementing PLE

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